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GUIDE TO WEED CONTROL

2010-2011

Publication 75

Discard old editions of this publication. Each year the appropriate sub-committee of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, the pesticide products listed in this publication were:

- federally registered
- classified by the Ministry of the Environment (MOE)

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This publication lists a number of brand names of pesticides. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

The Pesticide Label

Consult each product label before you use a pesticide. The label provides specific information on how to use the product safely, hazards, restrictions on use, compatibility with other products, the effect of environmental conditions, etc.

This pesticide product label is a legal document. It is against the law to use the product in any other way.

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The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticide products for use in Canada based on following an evaluation of scientific data to ensure that the product has merit and value; and the human health and environmental risks associated with its proposed use are acceptable.

1. Full Registration

Pesticide registrations are normally granted for a period of five years, subject to renewal.

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The PMRA has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Supplemental Labels

You **MUST** obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

- **Emergency Use Registration**
- **Minor Use Label Expansion**

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAFRA or PMRA's Pest Management Information Service.

For more information on the federal registration status check the PMRA website at www.pmra-arla.gc.ca or call 1-800-267-6315.

Regulation of Pesticides in Ontario

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All Pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at www.e-laws.gov.on.ca or call ServiceOntario Publications Toll-Free number: 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOE, the classification of pesticide products before they can be sold or used in Ontario. Once approved by the MOE, classified products are posted on the MOE website: www.ene.gov.on.ca.

Certification and Licensing

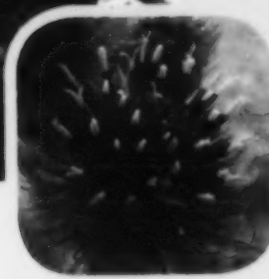
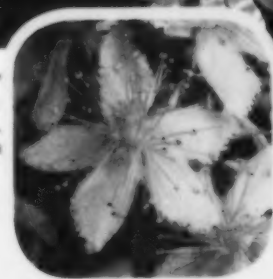
Growers and their Assistants

For information about certification for growers and training for assistants check the Ontario Pesticide Education Program website: www.opec.ca or call 1-800-652-8573.

Commercial Applicators and their Assistants

For more information about exterminator certification and licensing and technician training check the Ontario Pesticide Training & Certification website at www.ontariopesticide.com/OPTC/default.htm or call 1-888-620-9999 or 519-674-1575.

Cette publication est aussi disponible en français.



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Need technical or business information?

**Contact the Agricultural Information Contact Centre at
1-877-424-1300 or ag.info.omafra@ontario.ca**

Looking for production recommendations on the Internet?

www.ontario.ca/crops

It's one-stop shopping for Factsheets, articles and photos regarding the production management of Ontario crops.

Acknowledgements

Cover photos by Peter Smith and Annalee Winter – University of Guelph.

FRONT COVER Large photo: Scentless chamomile. Small photos (left to right): Flower of an hour, St. John's wort, Common burdock

BACK COVER Left to right: Wild carrot, Yellow nutsedge, Field violet



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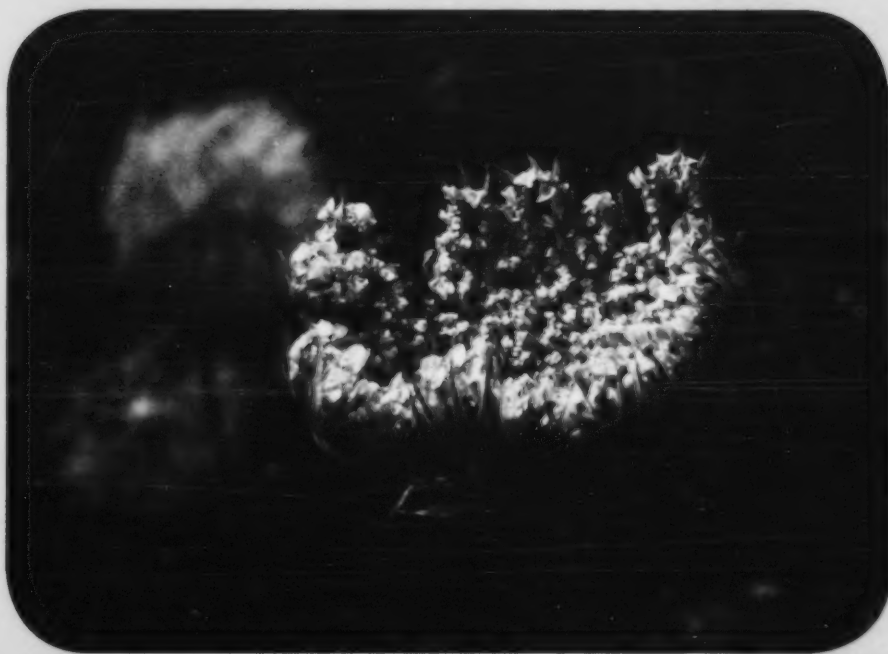
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1. PRINCIPLES OF INTEGRATED WEED MANAGEMENT

Integrated Weed Management (IWM) uses all available weed control strategies in the best possible way to manage weed populations. Such strategies include cultural, mechanical and chemical methods of weed control. All of these practices are components of an IWM system and none of these control measures on their own can be expected to provide acceptable levels of weed control. By following the principles of an IWM system we can reduce the use of herbicides and at the same time provide optimized economic returns to the grower.

Non-Chemical Weed Control

There are many different approaches to non-chemical weed control and success can only be achieved when several approaches are integrated into the weed management program.

- Identify and know weed species – annual, biennial, perennial
- Have a planned approach (flexible strategy)
- Check fields regularly to adjust strategy
- Tillage practices – no-till, conservation tillage, moldboard
- Secondary tillage frequency, timing
- Stale seed bed
- Crop rotation – crop competition
- Crop and variety selection
- Time of planting
- Row spacing, crop population
- Use clean crop seed
- Cleaning equipment between fields (cultivators, combines)
- Prevent seed production from weed escapes
- Fencerows and boundary areas

- Avoid excess nutrients
- Composted manure
- Cover crops – keep the soil covered, crop competition
- Healthy, biologically active soils
- Weed seed predation
- Mulch – plastic or crop residues
- Harrow – after planting, pre-emergence of crop
- Rotary hoe – after planting, pre-emergence of crop
- Harrow – after crop emergence
- Rotary hoe – after crop emergence
- Row-cultivation
- Thermal – flaming or steam/hot water
- Hoeing/pulling/walking the field
- Mowing

Field Scouting

Field scouting is a key component of an IWM system. It involves the systematic collection of weed and crop data from the field (weed distribution, growth stage, population, crop stage, etc). The information is used, in the short term, to make immediate weed management decisions to reduce or avoid economic crop loss. In the long term, field scouting is important in evaluating the success or failure of weed management programs and for making sound decisions in the future.

Crop Rotation

Crop rotation involves alternating different crops in a systematic sequence on the same land. It is an important strategy for developing a sound long-term weed control program. Weed species with growth requirements that are similar to the crop in which they are found tend

to thrive. Cultural practices designed to enhance the crop may also benefit the growth and development of these weed species. Monoculture, that is growing the same crop in the same field year after year, results in a build-up of weed species that are adapted to the growing conditions of the crop. When diverse crops are used in a rotation, weed germination and growth cycles are disrupted by variations in cultural practices associated with each crop (tillage, planting dates, crop competition, etc).

Cover Crops

The inclusion of cover crops such as rye, red clover, buckwheat and oilseed radish or overwintering crops like winter wheat or forages in the cropping system can suppress weed growth. Fast growing crops or crops exhibiting allelopathic properties can also suppress weeds. Highly competitive crops may be grown as short duration “smother” crops within the rotation. Additionally, cover crop residues on the soil surface will suppress weeds by shading and cooling the soil. Suppressing weeds in crop and after crop will reduce the numbers of viable weed seeds in the soil. When choosing a cover crop, consider how the cover crop and its management will affect the succeeding crop.

Intercropping

Intercropping involves growing a smother crop between rows of the main crop. Intercrops are able to suppress weeds. However, the use of intercropping as a strategy for weed control should be approached carefully. The intercrops can greatly reduce the yields of the main crop if competition for water or nutrients occurs.

Nitrogen Fertility

Nitrogen fertilizer can affect the competition between crops and weeds in the subsequent crops. For example, nitrate is known to promote seed germination and seed production in some weed species. Nitrogen fertilization may result in increased weed growth instead of increased crop yield. Selective placement of nitrogen in a band can favour the crop over the weed. Use of legume residues as opposed to chemical nitrogen fertilizer to supplement nitrogen needs of the crop can enhance weed suppression. Legume residues release nitrogen slowly with less stimulation of unwanted weed growth.

Planting Patterns

Crop population, spatial arrangement and the choice of cultivar (variety) can affect weed growth. For example, narrow row widths and a higher seeding density will reduce the biomass of later-emerging weeds by reducing the amount of light available for weeds located below the crop canopy. Similarly, fast growing cultivars can have a competitive edge over the weeds.

Tillage System

Tillage systems alter the soil seedbank dynamics and depth of burial of weed seeds. Almost 75% of the weed seedbank is concentrated in the upper 5 cm of soil in no-till fields. In the moldboard plow system however, the seedbank is more uniformly distributed over depth. Conservation tillage systems are intermediate to these two systems.

Weed seedling emergence is often more uniform from shallowly buried weed seeds and may result in better weed control. Weed seeds closer to the soil surface are more likely to be eaten or damaged by insects, animals, other predators and disease causing organisms.

Preemergent or “Blind” Harrowing

Blind harrowing consists of waiting until after the crop has been planted, the seed is sprouted and the shoot is not yet emerged. At this crucial time, the field is harrowed to kill the small weed seedlings that have already sprouted. The crop will emerge shortly afterwards, having gained a head start on the next flush of weeds. When properly carried out, this method can be most effective in controlling annual weeds in large seeded crops. In cereals, this blind harrowing will often provide adequate control of annual broadleaf weeds. In row crops, it can be used to suppress weeds until the crop plants are large enough to withstand other mechanical control methods. Any type of light harrow can be used. Crops underseeded with grass or legume seeds should not be blind harrowed.

Weeder Harrow

A weeder harrow has spring tines that are gentle enough not to harm the cultivated crop, while uprooting or covering the smaller annual weeds. Therefore, the relative size of the cultivated plants and the weeds is important. Weeder harrowing will be most successful when used before the crop emerges and can also be used post emergent in many crops. Some crop population loss will result. Speed and pressure settings are important to minimize plant loss. They can be used most effectively on field vegetables, corn, soybeans and cereals.

Rotary Hoe

The rotary hoe has “fingers” that lift and mix the soil, uprooting small weeds. It is important to work at 10–20 km/hr for satisfactory results. Best results are obtained during late morning or afternoon hours when the hot sun can dry out the uprooted weeds. Also, crop plants tend to be more pliable at this time and injury is reduced. Rotary hoes tend to cause less crop damage than harrows. They are also effective in breaking up a soil crust and mixing surface-applied herbicides into the soil, which will improve weed control. On light

soils or under loose soil conditions, care must be taken to keep the rotary hoe working at a shallow depth.

Inter-Row Cultivation

Shallow inter-row cultivation or scuffling of row crops uproots small weeds and cuts off larger ones. Various types of equipment can be used but, when shovels are used, allow for up to 50% overlap for thorough weed control. Shields should be used to protect small crops.

Inter-row cultivation can be used profitably when applying herbicides. The herbicide may be more effective and the amount of herbicide used can be reduced, particularly with band applications. To provide adequate weed control in long-season crops, such as corn, scuffling more than once may be necessary. The first cultivation is the most crucial since weeds that escape this pass can grow to maturity. Here again, the relative size of the crop to the weeds is an important and a factor in achieving 100% success. Use blind harrowing, weeder harrows and/or rotary hoes first to complement the inter-row cultivation to achieve success in non-chemical (organic) weed management.

Mowing

Mowing or cutting weeds may control weeds in orchards, roadsides, pastures, lawns, etc. Harvesting hay or cereal crops also helps to control weeds. Mowing cereal stubble in August can reduce weed growth and weed seed production. This is especially effective if the cereal is underseeded to another crop such as red clover to compete with the new weed growth. The best time to mow perennial weeds is usually at the bud stage when root reserves are low and before seed set. Note that if a herbicide application is planned for later in the season, adequate time should be left for weed regrowth after mowing.

For more information, see individual crop sections.

Critical Period of Weed Control

The critical period of weed control is an important concept in IWM systems. This period has been defined as an interval in the life cycle of the crop when it must be kept weed-free to prevent yield loss.

This concept helps in determining the most effective time for non-residual postemergent herbicide applications, and reduces the practice of season-long residual herbicides, and unnecessary late applications of herbicides. The critical periods are defined relative to a crop growth stage to account for soil, weather and seasonal variations. The crop must be weed-free during these stages to prevent a yield loss of more than 5%. See Table 1-1. *Critical Periods for Weed Control in Field Crops*, and Table 1-2. *Critical Weed-free Period for Horticultural Crops*.

If weeds have been controlled throughout the critical period, the weeds that emerge later will not affect yield and can be controlled prior to harvest, if necessary, with a harvest aid to burn down the weeds and desiccate the crop.

TABLE 1-1. Critical Periods for Weed Control in Field Crops

Crop	Critical Period for Weed Control
Corn	3rd to 8th leaf
Soybeans	1st to 3rd trifoliate
White Beans	2nd trifoliate to 1st flower

The critical period can vary depending on weather and growing conditions. Some research with corn and soybeans has indicated that the critical period may vary with soil type and tillage system where the end of the critical period may be extended slightly later on clay soils or when using no-till tillage systems.

Corn – The critical period extends from 3–8 leaf stage (4–10 leaf tip showing in the whorl, or V2–V6). Excellent weed control must be maintained throughout this critical period. Corn kept weed-free for approximately 34 days after planting (DAP) or 6–8 leaf stage (8–10 leaf tips) had a yield loss of 0–5% under conditions of heavy weed pressure.

Soybeans – The critical period extends from the first to the third trifoliate stage of soybean growth (V2–V3). Soybeans kept weed-free for approximately 15 days after crop emergence had a yield loss of 0–5%.

White beans – The critical period extends from the second trifoliate to the first flower (V3–R1) stage of white beans (approximately 45 days after planting).

Horticultural crops – These crops are very sensitive to weed competition, and should be kept weed-free from planting, emergence or budbreak, until the end of their critical weed-free period. This differs slightly from the critical period for weed control, but is useful for crops where soil applied preemergent herbicides or cultivation are the main option for controlling weeds. If the crop is kept weed free for the critical weed-free period, generally no yield reduction will result. Weeds emerging after the critical weed-free period will not affect yield, but control efforts after this time may make harvest more efficient, or reduce weed problems in subsequent years in perennial crops.

TABLE 1-2. Critical Weed-free Period for Horticultural Crops

Crop	Critical Weed-free Period
Apples, new plantings	During May and June
Apples, bearing	Budbreak until 30 days after bloom
Beets	First 2–4 weeks after emergence
Cabbage, early	First 3 weeks after planting
Carrots	First 3–6 weeks after emergence
Cucumbers, pickling	First 4 weeks after seeding
Lettuce	First 3 weeks after planting
Onions	For the whole season
Potatoes	First 4 weeks after planting
Squash	Unknown, but early plantings compete better
Strawberries, new plantings	During May and June
Tomatoes, fresh	First 36 days after transplanting
Tomatoes, seeded	First 9 weeks after seedling

TABLE 1-3. Percent Yield Loss of Corn Due to Uncontrolled Known Populations of Annual Broadleaf and Grass Weeds that Emerge with the Crop*

Annual broadleaves	% Yield Loss at 1 plant/m ²	% Yield Loss at 5 plants/m ²
Giant ragweed	13	36
Lamb's-quarters	12	35
Pigweed	11	34
Cocklebur	6	22
Ragweed	5	21
Wild mustard	5	18
Velvetleaf	4	15
Lady's thumb	3	13
Wild buckwheat	2	10
Eastern black nightshade	2	7
Annual grasses	% Yield Loss at 1 plant/m ²	% Yield Loss at 5 plants/m ²
Giant foxtail	2	10
Proso millet	2	10
Fall panicum	2	10
Barnyard grass	2	7
Green foxtail	2	7
Yellow foxtail	1	5
Old witch grass	1	5
Crabgrass	1	3

* Adapted from www.weepro75.com.

TABLE 1-4. Percent Yield Loss of Soybean Due to Uncontrolled Known Populations of Specific Annual Broadleaf and Grass Weeds that Emerge with the Crop*

Annual broadleaves	% Yield Loss at 1 plant/m ²	% Yield Loss at 5 plants/m ²
Cocklebur	15	41
Eastern black nightshade	14	40
Giant ragweed	14	40
Lamb's-quarters	13	38
Pigweed	12	36
Ragweed	10	33
Velvetleaf	6	23
Wild mustard	5	20
Lady's thumb	4	15
Wild buckwheat	4	15
Annual grasses	% Yield Loss at 1 plant/m ²	% Yield Loss at 5 plants/m ²
Volunteer corn	4	15
Giant foxtail	3	12
Proso millet	3	12
Barnyard grass	3	12
Fall panicum	2	10
Green foxtail	2	8
Yellow foxtail	1	5
Old witch grass	1	4
Crabgrass	1	4

* Adapted from www.weedpro75.com.

Economic Thresholds

Weed economic thresholds help in determining if weed density and interference are sufficient to justify control measures. The yield loss avoided should be greater than the cost of weed control. The time at which weeds emerge relative to the crop is a major determinant of yield loss. Early weeds that emerge at the same time as the crop cause more yield loss than weeds emerging

after the crop is established. For example, economic threshold studies conducted with redroot pigweed, ragweed and barnyardgrass have demonstrated that the time of weed emergence in relation to the crop stage is more important than weed density when evaluating weed control options. Crop yield loss depends on the relative time of weed seedling emergence. Tables 1-3 and 1-4 estimate the amount of yield loss associated

with certain weeds emerging at the same time as corn and soybeans.

Critical periods and economic thresholds do not apply to weeds like pokeweed and Eastern black nightshade which may reduce the quality of the crop. In these instances, there is no tolerance for such weeds.

Managing Weeds Resistant to Herbicides

Resistance of weeds to herbicides is not a unique phenomenon. In fact, resistance to antibiotics, insecticides and fungicides is a world-wide problem that is not confined to any single pest category.

In Ontario resistance has been reported to Herbicide Groups 2, 4, 5, 7, 9 and 22 as listed in Table 1-5. *Herbicide Resistant Weed Populations Confirmed in Ontario (as of Dec. 2009)*, page 6. In western Canada and the United States resistance has developed to Groups 1, 2, 3, 4, 5, 8 and 9 (refer to Table 4-6. *Herbicide Groupings for Ontario*, page 65).

Delaying Herbicide Resistance

Weed populations can change over time after repeated application of herbicides from the same group. This can result in reduced weed control due to resistant weed biotypes. Resistance to different types of herbicides develops at different rates among weed species and populations. To prevent or slow the development of herbicide resistant weeds on your farm, take the following approaches:

1. Identify and Monitor

Resistant weeds do not look different, therefore, they are hard to identify. Furthermore, “weed escapes” are common after herbicide application. Resistance does not usually become obvious until 10–30% of the population become resistant. Survey fields regularly and apply the methods of diagnosing herbicide-resistant weeds to detect catch problems as they arise.

2. Prevent the Spread of Weeds

When entering or leaving a field, clean all implements. Do not allow resistant weeds to go to seed.

3. Use Alternatives to Chemical Weed Control

Combine mechanical weed control, such as rotary hoeing or cultivation, with chemical weed control where possible.

4. Rotate Crops and Herbicides

Rotate herbicide usage so that the same herbicide group is not used year after year. One of the easiest ways to rotate to a new herbicide group is to rotate to a new crop and use a herbicide from an alternative group. Refer to Table 4-6. *Herbicide Groupings for Ontario*, page 65, for help selecting herbicides from different groups. This preplanning will prevent overuse of a herbicide group. When it is practical, use tank or formulated mixtures where both active ingredients within the tank act to kill the same weed in a completely different way.

5. Keep Records

Keep accurate records of crop rotations and herbicides used in all fields. It will be easier to plan long-term weed management strategies based on good records.

6. Communication

Connect with farmer organizations, weed and crop specialists, agribusiness, friends and neighbours about resistance problems they are encountering. Communicate to your government or industry representative about any cases of resistance to facilitate the appropriate action to prevent spread of the weeds.

Diagnosing Herbicide-Resistant Weeds

Before assuming that any weeds surviving a herbicide application are resistant, rule out other factors that might have affected herbicide performance. Those factors include misapplication, unfavourable weather conditions, improper timing of herbicide application,

and weed flushes after application of a non-residual herbicide. If resistance appears to be likely, check for the following:

1. Are other weeds listed on the product label controlled satisfactorily? Usually, only one weed species will show herbicide resistance in any given field situation. If several normally susceptible weed species are present, reconsider factors other than herbicide resistance.
2. Did the same herbicide or herbicides from the same group (see Table 4-6. *Herbicide Groupings for Ontario*, page 65) with the same site of action fail in the same area of the field in the previous year?
3. Do field records show extensive use of the same herbicide or herbicides from the same group year after year?

If one or more of these situations apply, it is possible that the weeds are resistant to the herbicide. If resistance is suspected, control the weeds with a labeled herbicide from another group or use appropriate non-chemical weed-control methods to prevent the weeds from going to seed. Next, contact a weed specialist, herbicide supplier and the appropriate chemical company to develop a comprehensive weed-control program to manage the problem.

For more information on herbicide resistance see:

- OMAFRA Factsheet, *Herbicide Resistant Weeds*, Order No. 01-023
- International Survey of Herbicide Resistant Weeds at: <http://weedscience.com/>
- Herbicide Resistant Weeds in Ontario at: www.plant.uoguelph.ca/resistant-weeds/

TABLE 1-5. Herbicide Resistant Weed Populations Confirmed in Ontario (as of December 2009)

Herbicide Group*	Weed Species	Location(s)
2	pigweed – redroot & green	Bruce, Elgin, Essex, Hamilton-Wentworth, Huron, Kent, Lambton, Middlesex, Oxford, Perth, Stormont, Dundas & Glengary, Wellington
2	common lamb's-quarters	Elgin, Essex, Kent, Lambton, Middlesex, Simcoe, Stormont, Dundas & Glengary
2	green foxtail	Huron, Lambton, Oxford, Perth, Wellington, Victoria
2	giant foxtail	Elgin, Lambton, Oxford
2	common cocklebur	Lambton
2	eastern black nightshade	Bruce, Elgin, Huron, Middlesex
2	common ragweed	Bruce, Elgin, Essex, Haldimand/Norfolk, Huron, Kent, Lambton, Middlesex, Niagara, Oxford, Perth, Prescott/Russel, Simcoe Stormont, Dundas & Glengary, Wellington
2	waterhemp	Bruce, Lambton, Essex
2 & 5	green pigweed	Bruce, Oxford, Perth, Stormont, Dundas & Glengary, Wellington
2 & 5	redroot pigweed	Oxford
2 & 5	common lamb's-quarters	Kent, Lambton, Simcoe
4	wild carrot	Halton, Wellington
5	common lamb's-quarters	Numerous counties throughout Ontario
5	green pigweed	Elgin, Huron, Wellington
5	redroot pigweed	Kent, Stormont, Dundas & Glengary, Waterloo
5	common ragweed	Brant, Essex, Haldimond/Norfolk, Hamilton-Wentworth, Lambton, Lennox & Addington, Niagara, Wellington
5	barnyard grass	Waterloo
5	yellow foxtail	York
5	old witch grass	Grenville, Grey, Haldimond/Norfolk, Prescott, Wellington
5	late flowering goosefoot	Brant
5	wild mustard	Glengarry
5	common groundsel	York
5	common waterhemp	Essex, Lambton
6	redroot pigweed	Essex, Kent
6	smooth pigweed	Essex
7	green pigweed	Simcoe
7	redroot pigweed	Middlesex, Simcoe
22	Canada fleabane	Essex
22	field peppergrass	Essex

*The above weed populations have been found to be resistant to some or all of the herbicides in the indicated herbicide group. Refer to Table 4-6, *Herbicide Groupings for Ontario*, page 65 for a list of herbicides associated with each herbicide group.

Testing for Herbicide-Resistant Weeds

The Department of Plant Agriculture at the University of Guelph can test for resistance of suspected weed species. For more information call 1-877-424-1300.

Use of Chemicals to Control Weeds

Chemicals may be used to control weeds either selectively in crops or non-selectively on non-crop areas, such as roadsides, fencerows and areas difficult to cultivate. The treatments listed in this publication are based on extensive field trials and observation on farms. Herbicides should not be used in cold frames or greenhouses unless specifically recommended.

Time of Herbicide Treatment in Crop Areas

The susceptibility of both crops and weeds to herbicides is related to the time of application. Therefore, it is important to use the chemical at a time when the crop is at its maximum resistance and the weeds are at their maximum susceptibility. This time will vary depending on the crop involved and the herbicide used. Refer to the stage of development of the crop plants unless otherwise specified.

Preplanting Treatments

Preplanting (PP) treatments are applied before the crop is planted. Some herbicides used in this way act on germinating weed seedlings, others may also kill weed seeds. When used prior to planting, some herbicides must be thoroughly incorporated (PPI) with the soil soon after application. Directions for incorporation are given throughout the publication where these herbicides are listed.

Preemergence Treatments

Chemicals used in preemergence (PRE) treatments are applied after seeding but before the specified weed or crop emerges. The chemicals may control weeds by killing weed seedlings and/or establishing a toxic layer of chemical on or near the soil surface in which germinating seeds and young seedlings cannot survive.

For successful preemergence treatments the crops must either be tolerant of the chemical at the seedling stage or the toxicity must have disappeared before the crop emerges.

A smooth, well-prepared seedbed that is free of clods is necessary for best results. The surface soil should also be moist and the temperature favourable for the rapid germination of weed seeds.

Postemergence Treatments

Postemergence (POST) treatments are applied after the crop and weeds have emerged. A selective chemical is used and the weeds are killed with little damage to the crop. The types of weeds that may be controlled depend on the susceptibility of the weed, and the tolerance of the crop to the chemical. Treatment at the correct stage of crop development is important. Since most weeds are more susceptible to chemicals when young, early treatments will require less herbicide and will result in less damage to crops from weed competition and from spray equipment.

Sometimes a herbicide may be applied postemergence to the crop but preemergence to the weeds. For example, a crop may be cultivated, then a herbicide applied to the weed-free soil to control germinating weeds.

Conservation Tillage

All herbicides listed for use in specific crops in the conventional tillage sections of this publication can be used in conservation tillage systems provided that they

are used according to the labeled uses and the labeled rates.

Minimum Tillage involves very little use of tillage equipment for seedbed preparation. The soil, however, is tilled prior to seeding, resulting in somewhat rough planting conditions by conventional standards. There is very little living vegetation and a crop residue cover of more than 20% after seeding. Weed control in this cropping system is similar to weed control in conventional tillage. Preplant incorporated herbicide treatments may not be practical if crop residues are heavy. Good uniform soil mixing is required to produce satisfactory results with incorporated herbicides. If this condition cannot be achieved without extra tillage, then the preferred method would be to use preemergent or postemergent herbicides. Use inter-row cultivation with herbicides. Burndown treatments are not normally required.

Ridge Tillage involves seeding the crop directly into the ridge formed by aggressive cultivation the previous year. The ridge planter skims off 2–5 cm of soil, crop residue, weeds and weed seeds from the top of the ridge and deposits these in the hollows between the rows. Preplant incorporated treatments are impractical with this system. This system is well suited to broadcast and/or banded applications of preemergent or postemergent herbicides. Excellent results have been obtained by band-applying preemergent herbicides at planting time to fresh, moist soil directly behind the seeding unit on the planter. Also, timely cultivation between crop rows and spraying the crop row with postemergent herbicides can provide excellent weed control. The ridging procedure that follows provides additional mechanical weed control. Proper adjustment of the ridge planter and early cultivation after seeding may eliminate the need for a burndown treatment. A burndown treatment may be required prior to crop emergence if cultivation is delayed after seeding.

Strip Tillage suggests that only narrow bands of soil in the seeding area are tilled by either power-driven rototillers or fluted coulters. The area between rows is left untilled and the crop residue is undisturbed. Success with preplant incorporated treatments depends on the amount and type of residue, the nature of the specific herbicide and the tilling device used. Row middles are not usually cultivated but could be if appropriate equipment is available for inter-row cultivation. Usually a broadcast application of preemergent or postemergent herbicides is used. Band applications could be used if inter-row cultivation is an integral part of the production system. If vegetation is present at seeding time, a burndown treatment is necessary.

No-Till cropping systems are the most demanding with regards to weed control. The crop is seeded directly into untilled soil with no follow-up cultivation. Weed control depends entirely on herbicides. Burndown treatments are almost always required. Preemergent and postemergent herbicides are used to control weeds throughout the growing season. Crop residues may intercept a portion of the preemergent herbicide. If rainfall is sufficient to wash the herbicide from the crop residue into the soil, weed control results will be satisfactory. However, if dry conditions follow application, reduced weed control may occur. Postemergent foliar-applied herbicides are more appropriate under dry conditions.

Weed Population Shifts

Weed population shifts refers to the changes in the kinds of troublesome weeds that occur with a change in tillage systems. When tillage is reduced the environment of weed seeds and underground parts of perennial weeds is altered. These environmental alterations affect weed species differently. Deep burial of weed seeds under conventional tillage systems enforces seed dormancy and increases the life of seeds, perpetuating weed problems. Reducing tillage keeps more

weed seeds at the soil surface where they are subject to the ravages of nature. Greater percentages of seed at the soil surface are destroyed before they germinate (by winterkill, birds, insects or rodents). Most seeds that do survive germinate sooner and, if they are controlled, they do not return seeds to the soil. If good weed control is obtained in the early years of reduced tillage, eventually the weed seeds in the soil become fewer, reducing the potential of serious weed problems that originate from seed. Pressure from annual weeds tends to decline after a few years in reduced tillage. On the other hand, reduced tillage favours weeds that reproduce from underground roots and stems; these underground parts are less likely to be mechanically injured or destroyed in reduced tillage systems. Perennial and biennial weeds tend to be more troublesome in ridge-till, strip-till and no-till fields. In reduced-tillage fields, these weeds emerge earlier and do not spread as much as they do in conventionally tilled fields. This allows more appropriate timing for spray application and more spot treatments. The most effective herbicides are foliar-applied systemic types that translocate well to underground plant parts before the above-ground parts are killed. When non-selective herbicides are used, perennial and biennial weeds must be treated between crops or the crop must be sacrificed in treated areas.

Burndown treatments are meant to kill existing vegetation before crops emerge. Burndown treatments may be required in minimum tillage, especially when cover crops are used. They may also be required in ridge-till when seeding is delayed and/or when winter annual, biennial or perennial weeds are present. Burndown

treatments are almost always required in no-till and strip-till fields. Vegetation can be killed by:

- contact herbicides like paraquat
- translocated systemic herbicides like glyphosate, dicamba or 2,4-D
- residual herbicides that have postemergence foliar activity such as atrazine, linuron or metribuzin plus surfactants or oils
- contact or systemic herbicide tank mixed with a residual herbicide such as paraquat + atrazine or glyphosate + dicamba

All of these treatments are most effective on young, actively growing plants. Coverage is extremely important with contact treatments. Burndown treatments do not necessarily provide residual weed control.

When dense, vigorous growing vegetation is present just before or at planting time, large amounts of soil moisture are removed by that vegetation. This can be an advantage during springs when there is an over-abundance of soil moisture, but is a definite disadvantage during springs when dry conditions prevail. Consideration should be given to early application of burndown herbicides, perhaps even the previous fall when perennial cover crops or sod fields are involved. Under dry conditions, a rapid-acting burndown would be preferred over a slower-acting treatment.

For more specific information see the individual crop sections such as Corn (Field, Seed and Sweet) in Chapter 9 on page 105 and Soybeans, in Chapter 11 on page 159.

Applying Herbicides

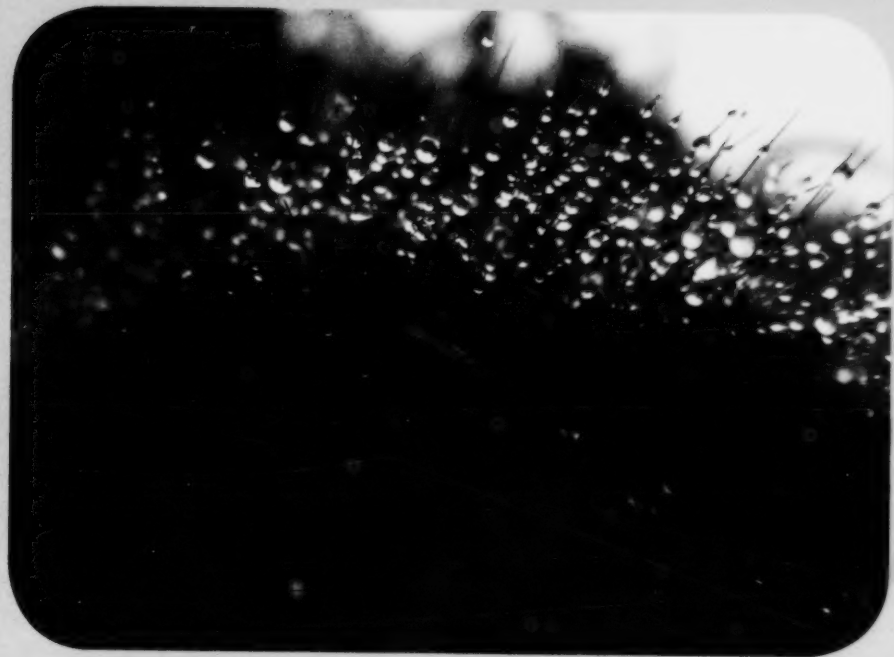
An exterminator's license may be required by a person applying herbicides on property other than their own. An operator's license is required by a person operating an extermination business. For further information, contact any Ministry of the Environment Regional Office or the Ministry of the Environment Pesticides Section, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.

Successful chemical weed control requires the application of the correct quantity of herbicide uniformly over the area. With selective weed control in field crops, this application becomes a precision operation.

The chemical is applied as an emulsion, solution or suspension. The volume of the mixture used per hectare depends on the herbicide and the crop being treated. Generally, low volumes (50–200 L/ha) are used when phenoxy herbicides (e.g. 2,4-D) are sprayed on emerged weeds, and higher volumes (150–300 L/ha) when preemergence herbicides are applied.

Small areas may be treated with a garden sprayer, or even with a watering can, if care is taken to wet all foliage.

Power equipment is necessary for larger areas. Equipment used for applying 2,4-D-like chemicals should not be used later for applying other solutions to 2,4-D susceptible crops or garden plants.





2. APPLICATION TECHNOLOGY

Introduction

Herbicide application should be a precision operation. Recent advances in equipment and control systems can make the job relatively simple and precise.

Pesticides applied incorrectly may result in wasted pesticide, poor or no control, damage to crops (possibly the neighbour's) or environmental contamination. Every effort must be made to apply chemicals properly.

Developments in New Equipment

In building sprayers that accurately apply herbicides, equipment manufacturers work closely with the crop-protection industry. Innovations, such as closed-injection systems with herbicide concentrate carried separately from the water carrier, are now in use. Electronic rate controllers provide more accurate spray application by utilizing speed sensors, flow controllers and microprocessors to maintain the desired application rate. This technology has also included radar to accurately sense true ground speed of the sprayer. Rate controllers are commonly used by professional applicators.

The industry is currently working towards the closed-injection system. Work continues in the area of drift reduction using air assists and electrostatic methods.

Air-induction nozzles significantly reduce spray drift and are available in a range of sizes from a number of suppliers. Operating these nozzles within their working pressure range is crucial to ensure designed spray angle development and proper air induction into the nozzle. Before buying air induction spray tips, make sure your sprayer pump can produce sufficient pressure to

operate these tips under all conditions. Check with the nozzle manufacturers for operating pressures required.

Field Sprayers

The most common sprayer used in herbicide application is the boom-type sprayer. This sprayer applies a uniform amount of spray solution across the width of the boom.

The main requirements for field spraying are:

- a uniform pressure across the whole boom
- all nozzles have the same output and a good spray pattern
- a uniform forward speed in actual field conditions
- a stable boom height to ensure proper overlap of the nozzle-tip patterns

Most commercially built sprayers can be adapted and used safely to apply liquid fertilizers. Extra agitation may be required. Ensure that the sprayer components being used are compatible with the fertilizer formulation and follow the manufacturer's recommendations.

Air-Blast or Mist Sprayers

These machines should never be used to apply herbicides, especially hormone-type herbicides such as 2,4-D. The danger of causing herbicidal damage at a great distance from the treated area is very high.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate. Check product labels for use of this application

technique with other herbicides. Product labels list the crops for which this technique is registered. The main criteria for using wiper applicators are:

- contact enough of the target plant to get herbicidal effectiveness
- keep the wick application above the crop to avoid crop injury

Travel speeds should be 4–10 km/hr for wick application. Two passes in opposite directions may be beneficial, especially in heavy weed infestations and where higher vehicle speed is contemplated. Care must be taken not to contact sucker growth in orchards, vineyards and shelterbelts. This may result in crop injury.

Care and Use of Equipment

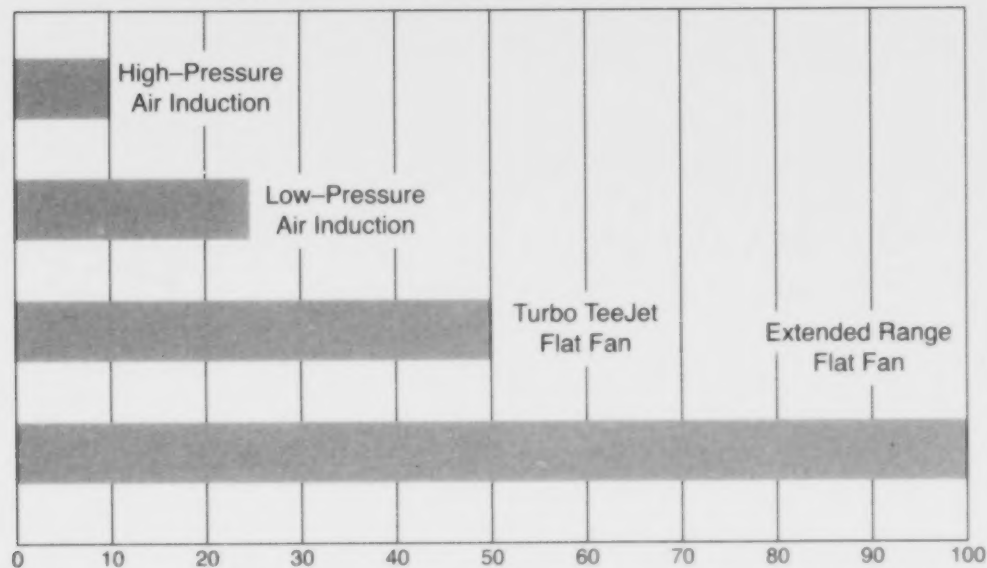
Spraying Speeds

Because most agricultural and roadside herbicide must be uniformly applied, the forward speed of a sprayer must be constant whenever the nozzles are delivering liquid. If the driving wheels of a tractor slip on the soil surface, the tractor's speedometer does not indicate a change in forward speed. To be certain that the forward speed is constant in spite of wheel slippage on hills, or loose soil, use an independent speedometer powered by a non-driven wheel. Spray monitors and other electronic rate controllers also may be installed. Only rate controllers will automatically adjust for variation in tractor speed to maintain a constant rate of application.

Water

Use only clean water that contains no debris, sand or mud. On your farm water supply, use a frost-free water

FIGURE 2-1. Conventional vs. Air Induction Nozzles



**Air Borne Spray Drift Potential Expressed as
a Percentage of the Drift from an Extended Range Flat Fan Nozzle**

hydrant located outside a building. An anti-backflow or anti-siphon valve should always be installed on any hydrant or water supply. Never allow the intake screen to rest on the bottom of a farm pond while filling a sprayer. The intake line near the screen must, by law, be equipped with a check valve or anti-backflow device to prevent contamination of the pond or stream when the pump is shut off. Tank-refilling nozzles, volume-booster nozzle or injection pumps should not be used to refill the sprayer tank from farm ponds or streams. These tank-refilling aids may cause pond or stream contamination.

Agitation

When chemical formulations in solution are used (e.g. 2,4-D and water) at least 2–14 L of spray solution

should be returned to the tank each minute to provide adequate agitation. Higher rates will apply with wettable powders. To be effective, the agitation line from the pump should pass through a control valve and deliver the liquid to the bottom (not the top) of the tank. Agitation nozzles or a sparge tube should always be used to ensure sufficient liquid circulation in the tank.

When wettable powders (atrazine, etc.) are used, the return to the tank should be 14–27 L/min for each 450 L of tank capacity, depending on the concentration of the wettable powder and the size of the tank. A dedicated line from the pressure side of the pump (not the pressure regulator) to the tank must be used to carry the liquid necessary for hydraulic agitation in the tank. Always use a venturi jet or sparge tube. This flow can be

reduced if the sprayer has a mechanical agitator. Sparge tube agitation requires more water than venturi nozzles to give the same agitation.

Avoid excessive agitation of the mixture, as it may turn into an invert emulsion, a grease-like mass that will settle to the bottom of the tank and cannot be pumped. Excessive agitation may also cause foaming resulting in pumping problems. To prevent a build-up of oil in the sprayer, the tank should be emptied completely before refilling. After any break in the spraying operation, agitate thoroughly before resuming operation. Clean the tank and sprayer immediately after use with a detergent or solvent and flush with clean water.

Pumps

The pump is the most important part of the sprayer. The pump should have adequate capacity to maintain the desired pressure, volume and agitation. Piston, diaphragm and centrifugal pumps are best for pumping wettable-powder suspensions. For liquid herbicide applications, roller pumps may be used in addition to the above types. When used for wettable powders or flowable formulations, choose a pump with an abrasion resistant housing. Carefully follow the manufacturer's care and storage instructions for the best pump performance.

CAUTION: Running a spray pump without water may cause damage or premature wear.

Nozzle Tips

Numerous companies make spray nozzles. Nozzles from different suppliers may be similar in design but may differ in setup requirements. Always follow manufacturers' recommendations for nozzle spacing and nozzle-to-target distances. These distances may vary according to the spray angle of the nozzle. Proper

spacing and orientation of nozzles is essential to ensure adequate overlap of adjacent nozzle spray plumes.

Care should be taken to maintain a stable boom height to assure uniform overlap of the nozzle spray patterns.

The success of the spray application is dependent in part on the condition of the nozzle tips and the uniformity of application across the whole spray boom. The spray pattern of all nozzles should be examined prior to their use. In addition, each and every nozzle should be checked when calibrating the sprayer.

Materials used for nozzle tips range from brass, stainless steel, hardened stainless steel, as well as plastics/polymers and ceramics. All product formulations and carriers cause wear of the nozzle orifice. Wettable powders cause more wear than others formulations.

Sprayers should be calibrated regularly (see note on calibration below).

Nozzle tips should be replaced when they deliver 10% more than manufacturer's rated output specifications. Worn nozzle tips may provide uneven distribution of spray solution and cause undesirable spray patterns.

Flat fan nozzle tips are widely used on boom sprayers to apply herbicides. Spraying operating pressure should be within limits specified by the nozzle manufacturer. Nozzles with a 110 degree spray angle have more overlap than 80 degree nozzles, resulting in a wider spray angle. This allows less chance of spray skips as the boom moves closer to the ground. Always follow manufacturer's recommendations for spacing minimum nozzle to target distance and spray operating pressures.

Flat fan nozzle tips that will operate at reduced pressure, approximately 140 kPa, are available. These nozzle tips can further reduce the potential of drift.

Air induction or venturi nozzles are now available from at least ten different suppliers. These nozzles were specifically designed to reduce the amount of fine droplets produced in the smaller nozzle sizes. The nozzle manufacturers offer air induction or venturi nozzles in a wide range of sizes.

These nozzles draw air into the nozzle as the spray liquid passes through the nozzle. The result is a coarse spray with very few fine spray droplets that are prone to drift. These coarse droplets contain air bubbles that cause the droplets to rupture upon impact with plant surfaces.

Air induction nozzles are made for two pressure ranges, low pressure and high pressure. If a sprayer cannot exceed 345 kPa, only consider a low-pressure design. All venturi nozzles should be operated in the middle of their working range. For the low pressure designs this is approximately 275 kPa and in the high-pressure designs, about 550 kPa. All venturi nozzle designs are extremely sensitive to low working pressure. The spray patterns will collapse to less than their designed spray angle if the nozzle pressure is too low. This will result in a distorted spray pattern. In addition, the induction of air into the spray liquid will not occur if the pressure goes below a certain point.

Many producers have quickly adopted this new nozzle technology. The significant reduction in spray drift, compared to conventional flat fan nozzles, is a welcome feature. Some producers are using these nozzles for all their herbicide spraying.

Some product performance problems have occurred when air induction or venturi nozzles have been used. One or more of the following factors may contribute to this. Poor timing of spray, reduced water volumes, spray pressures that are too low and difficult-to-wet weeds may all contribute to poor control.

Special even-spray nozzle tips are available for band spraying applications of herbicides. These even flat fan nozzles deliver a uniform amount of spray over their sprayed area. A variety of sizes, spray angles and nozzle materials are available. The nozzle-to-target height, and spray angle of the nozzle tips as well as their orientation to the direction of travel, determines the width of the sprayed band. Carefully follow the manufacturer's literature and directions.

Flooding nozzle tips are used at low pressures and, because of their wide spray angle, can be used closer to the ground surface, thus reducing the potential for drift. New flooding nozzle tip designs have improved the spray distribution patterns to the point that it is as good as with the flat fan tips. Flooding nozzle tips are available in brass, plastic/polymers and stainless steel. Half as many of these nozzle tips are required to cover the same width as would be required with flat fan nozzle tips. Sprayers equipped with a broadcast type of nozzle cover a wide swath. They are especially convenient for farm lane and fencerow spraying where a uniform spray pattern is not essential. The spray pattern is affected by wind and severe drifting may occur with even a light breeze. Never use a broadcast-type of nozzle to spray near a susceptible crop.

Full or hollow cone nozzle tips may be used for applying herbicides to the soil surface when the herbicide is incorporated or mixed into the soil with a disk harrow, cultivator or similar tillage implement.

NOTE: When using any nozzle for spraying wettable powders or micro-nutrients, it is essential to calibrate the sprayer frequently because, as a nozzle wears, the quantity of spray material delivered increases and distribution is uneven. Worn nozzles usually result in a poor spray pattern.

Nozzle manufacturer's catalogues will list screens required for various nozzle types and sizes. Diaphragm check valve nozzle bodies will ensure dripless operation when the boom is turned off. To clean nozzle screens, remove them from the nozzle bodies and wash thoroughly with soap and water, using a nozzle tip bristle brush. Simply flushing water through the boom and nozzles will not remove pesticide residue that has built up on the outside of the nozzle screens.

Cleaning the Sprayer

Before cleaning the sprayer, dispose of surplus tank mix. As suggested in the Grower Pesticide Safety Course, one method of disposal is to dilute the remaining spray solution at least 10:1 with water. This diluted solution can be applied to the previously treated area as long as the maximum recommended product rate on the label, is not exceeded.

Clean out the sprayer immediately after finishing the day's work or when changing chemicals. At the end of each spray day, thoroughly flush out the boom with plenty of water to rinse lines, diaphragm check valves and nozzles. Delaying cleanout, even overnight, can allow the formation of hard-to-remove deposits. The sprayer tank is much more difficult to clean out, if it is allowed to dry. Don't forget to also clean out the measuring containers.

Steps:

1. Read the product label to determine the recommended cleaning procedure. Have all the materials required for the cleanup ready, including appropriate personal safety equipment.
2. Drain spray tank.
3. Fill tank with water and add detergent, ammonia or other tank cleaner product and agitate for 10–20 minutes (clean the whole tank not just the bottom half). Flush boom and hoses with solution, allow to stand for several hours (or overnight if possible) and then flush boom and nozzles again and drain the tank. When flushing the boom, open the boom ends to get particles out of the boom.
4. Inspect the inside of the tank for visual residues. Rinse the inside of the tank if necessary. Repeat step 2.
5. Wash the outside of the sprayer with soap or mild detergent and water.
6. Remove nozzles, screens, and wash separately in a bucket containing cleaning solution. Wash out measuring containers with the cleaning solution.
7. Remove all boom end plugs or caps. Product residues collected in the ends of the various boom pipe sections could cause crop injury. Thoroughly clean out the plugs or caps and pipe ends with cleaning solution. Carefully replace all the boom end plugs or caps.

Thoroughly rinse the tank, hoses, booms, nozzles and screens with clean water for a minimum of 10 minutes. Repeat immediately before the next use.

Use household detergent at rate of 250 mL/100 L or 1 kg/150 L of water. Use ammonia (3%) at 1 L/100 L of water. Use other cleaning agents according to label directions. Never mix ammonia with chlorine bleach. Chlorine gas is produced which may cause severe eye, nose, throat, or lung irritation.

NOTE: Contact the manufacturer of pesticides being used to determine the best methods and product(s) to clean residue from tanks and associated equipment. Read the label, since many products, e.g. ACCENT, BANVEL II, CONQUEST, PEAK, etc. provide tank-cleaning information on their label. Some products such as AGRAL 90, or ALL CLEAR, are recommended as tank cleaning agents.

Do not use equipment that has applied Group 4 (2,4-D, MCPA and related phenoxy herbicides) or many of the Group 2 herbicides should not be used to spray fungicides or other materials on susceptible crops. Do not park or store such sprayers near greenhouses or other areas where susceptible crops are grown.

Clean the spray tank, booms and hoses first. Be sure to also clean the nozzles and tips, screens, filter, strainer and pump. These parts are often overlooked, and can trap residues. Because many herbicides are highly active and concentrated, it is essential to clean out every trace of herbicide.

When surfactants or fertilizer solutions (e.g. AGRAL 90, 28% UAN) are used in a recommended mix with herbicides, there may be some inadvertent cleaning of previous residues from the tank or equipment that could affect the crop. Proper cleanout when changing products is essential to prevent crop injury.

The wash water contains herbicide. Never allow wash water to run into a well, lake, pond, river or other water source.

Do not leave puddles that may be accessible to children, pets, farm animals or wildlife.

Sprayer Calibration

Field Boom-Type Sprayer Calibration

(Determining application rates in L/ha.)

There are many ways of determining the rate of spray material that is being applied to 1 ha of land.

Instructions

1. Measure the time.

- Place two stakes 50 m apart in the field.
- Select the gear and throttle setting (rpm) at which you plan to spray. Half-fill the sprayer with water.
- Drive the distance between the stakes three times, timing each pass. Each time, make sure the tractor is at the desired speed as you pass the first stake. Continue driving at this speed until you pass the second stake.
- Note the average time of the three passes.

2. Measure the average nozzle output.

- Park the sprayer with the PTO engaged and the throttle adjusted to reach the PTO speed set in the test run.
- Adjust the pressure regulator to the desired working pressure with full flow to the boom.
- Collect the output from each nozzle for the average length of time needed to travel the 50 m in the test run.
- Enter the nozzle outputs into the equation below.

- If any nozzle is more than 5% above or below the average output, it should be cleaned or replaced.

3. Measure the nozzle spacing in metres.

4. Use the following formula to determine the sprayer output:

$$\text{Sprayer Output} = \frac{\text{Average Nozzle Output (mL)}}{\text{Nozzle spacing (metres)}} \times 0.2$$

(Litres/hectare)

5. Calculate the actual area sprayed after each tank of spray solution is applied. Re-check the sprayer calibration after each tank of spray is applied by dividing the volume sprayed by the area sprayed. The nature of some products may slightly alter the calibration from that of clean water.

6. Growers who prefer to measure in litres/acre or gallons/acre can use the following conversion guide.

$$\text{Litres/hectare} \times 0.4 = \text{L/acre}$$

$$\text{Litres/hectare} \times 0.09 = \text{Imp. gal/acre}$$

$$\text{Litres/hectare} \times 0.11 = \text{U.S. gal/acre}$$

Sample Calculation

$$\text{Average time to travel 50 m (164 ft)} = 24.5 \text{ sec}$$

$$\text{Average amount of liquid collected per nozzle for 24.5 sec} = 525 \text{ mL}$$

$$\text{Nozzle spacing on the boom} = 0.5 \text{ m (}\approx 20 \text{ in.)}$$

$$\text{Application rate} = \frac{525 \text{ mL} \times 0.2}{0.5 \text{ m}} = 210 \text{ L/ha}$$

$$210 \text{ L/ha} \times 0.4 = 84 \text{ L/acre}$$

$$210 \text{ L/ha} \times 0.09 = 18.9 \text{ Imp. gal/acre}$$

$$210 \text{ L/ha} \times 0.11 = 23 \text{ U.S. gal/acre}$$

Band Spraying: If the sprayer has 10 nozzles and each nozzle covers a 36 cm (0.36 m) band, the total width of the spray patterns (swath width) is: 10 x 0.36 or 3.6 m.

NOTE 1: Sprayer-calibration bottles or kits are available from a number of suppliers. For further information contact your local office of the Ontario Ministry of Agriculture, Food and Rural Affairs or manufacturers of sprayers, sprayer parts or herbicides.

NOTE 2: For banded-spray applications, measure the width of the spray band (at the soil surface or surface of the crop canopy) and enter this value into the formula instead of the "nozzle spacing". Note that in band spraying the acreage sprayed is not the same as the crop acreage. (When broadcast spraying a row crop with 1 m rows, the whole field is treated. A band spray may only treat 30 cm over each row. Therefore, only about 1/3 of the field is actually treated. The herbicide rates referred to in most herbicide publications and labels refer to the actual area sprayed unless otherwise stated.

Hand-Held/Backpack Sprayer Calibration

Many people use small hand-held or backpack sprayers for treating problem areas or spraying areas that were missed. Calibration of these sprayers is as important as calibrating your field sprayer.

Method 1

1. Measure an area that is 100 sq. m.
e.g. 10 m x 10 m, or 25 m x 4 m
2. Fill the spray tank with water. Mark the level on a measuring stick. Pump to the pressure that will be used during the pesticide application.
3. Spray the water over the 100 sq. m area. Walk at a steady pace, taking care to apply it as evenly as possible, just as you would when applying pesticide.

4. Measure the amount of water needed to refill the spray tank to the mark on the measuring stick. This amount will be the sprayer output per 100 sq. m.

Method II

1. Set two stakes 50 m (164 ft) apart in the field.
2. Half-fill the sprayer with water.
3. Walk the 50 m three times at a steady pace. Calculate your average time to travel the 50 m.
4. Measure the width of the band sprayed by the nozzle (in metres) at your walking pace.
5. Pump the sprayer for the same amount of time as calculated in Step 3, collecting the liquid from the nozzle in a measuring device.

$$6. \text{ Application rate (L/ha)} = \frac{\text{mL liquid per nozzle}}{\text{Band width (metres)}} \times 0.2$$

Method III

1. Partially fill sprayer. Pump to the pressure you will use during the pesticide application.
2. Spray to determine width of swath (in metres).
3. Walk at a steady pace for 15 seconds. Measure the distance (in metres).
4. Multiply spray width times distance travelled to provide the area (in square metres) sprayed in 15 seconds.
5. Spray into a measuring device for 15 seconds – gives amount of solution sprayed in 15 seconds.

$$6. \text{ Application rate (L/ha)} = \frac{\text{amount sprayed}}{\text{area (length} \times \text{width)}} = \frac{\text{L} \times 10,000}{\text{sq. metres}}$$

To convert the application rate of any pesticide to the amount required for a small area, follow this guide:

- 1 kg/ha = 10 grams/100 m²
- for liquid measure, 100 L/ha = 1 L/100 m²

(Source: Ontario Pesticide Education Program Manual 1995).

Determining Amount of Herbicides Needed

Determining Amount of Product Per Hectare

Most rates suggested in this publication are given in terms of both active ingredients (common name) per hectare and product (TRADE NAME) per hectare. However, where the amount of active ingredient in the formulations varies considerably (for example, 2,4-D is available in concentrations of 100 g/L, 400 g/L, 500 g/L, etc.) The rate is given in terms of active ingredient only.

NOTE: Throughout the Crop Recommendations sections of this publication, the common name of each herbicide (its active ingredient) is printed in lowercase letters (e.g., atrazine, dicamba, glyphosate), whereas the product trade name (the name of the liquid or powder etc., inside the container as supplied by the manufacturer) is printed in capital letters (e.g. AATREX, BANVEL II, glyphosate), and its formulation is listed within brackets following the trade name.

Determining Amount of Product Required Per Tankful

After determining how much commercial product is needed per hectare, calibrate the sprayer and determine

the number of hectares each tank will cover. Determine the quantity of herbicide needed to add to the spray tank using the following formula:

$$\text{Product required/tank} = \frac{\text{hectares covered by tank}}{\times \text{product rate/ha}}$$

Sample calculations:

$$\begin{aligned} \text{(a) product/tank} &= 4.1 \text{ ha} \times 2.2 \text{ kg/ha} \\ &= 9.02 \text{ kg LOROX/tank} \\ \text{(b) product/tank} &= 4.1 \text{ ha} \times 4.5 \text{ L/ha} \\ &= 18.45 \text{ L ATRAZINE/tank} \end{aligned}$$

Follow manufacturer's recommendations on mixing order and procedures.

Materials, Mixing and Mixtures

Dry herbicide formulations include granules, soluble powders and wettable powders. Granules do not require prior mixing into a slurry. They are ready to be mixed in water. Soluble powders can be dissolved in water. Wettable powders will not dissolve but will form a suspension that requires constant agitation.

Liquid herbicide formulations either mix in water to form a solution or may be oil-based and form an emulsion that will require agitation.

Pesticide labels usually provide mixing directions for registered tank-mixes, often describing the order of mixing. Whenever a label provides mixing directions, they should be followed. Consult the package labels for information on the compatibility of different herbicide products as certain formulations may react when mixed together, resulting in materials with different properties and activities than the original ones. If the pH or hardness of the water requires adjustment, adjustments should be made prior to the addition of spray material to the tank.

When the label does not provide mixing instructions for a registered tank-mix, pesticides should generally be mixed using the following procedure:

- Fill the spray tank with water to $\frac{1}{2}$ of the total spray volume required and start agitation. Add the different formulation types in the order listed below, allowing time for complete mixing and dispersion after adding each product.
 1. dissolvable packs
 2. wettable powders
 3. water dispersible granules and dry flowables
- Maintain agitation and fill spray tank to $\frac{3}{4}$ of total spray volume. Then add:
 4. water-based solutions
 5. emulsifiable concentrates
 6. spray adjuvants
- Finish filling the spray tank to the required volume. Maintain continuous agitation during mixing and final filling, and throughout application.

Mixtures of different herbicides or mixtures of herbicides with pesticides or foliar fertilizers should not be applied in a single application unless registered for use in this way.

Unless specifically mentioned in this publication, or on a herbicide label, the addition of a surfactant or a detergent to a spray solution is not recommended.

Where water is known to have an excessive salt content, compatibility of the water and the chemical at field strength should be tested first on a small scale. See note on Agitation in the Care and Use of Equipment section.

Application Indicators

Colourants/Foam Markers for Pesticides Application

Colourants added to the pesticide solution help show where pesticides have been applied. Foam marking systems help minimize overlap. Adding a colourant to the basal sprays of herbicides on cut stumps of woody plants helps assure thorough coverage without respraying. Examples of colourants are listed below.

- Blazon: blue, water soluble
- Bas-oil Red : red, oil soluble
- Dye Red Foam

Colourants are available from agricultural chemical dealers.

Additional Information

Video

No. 39, *Field-Crop Sprayer Calibration*

No. 44, *Nozzle Selection for Field Sprayers*

Available from:

Independent Study, University of Guelph,
Guelph, Ontario Canada N1G 2W1.

Phone (519) 824-4120 ext. 3375.

www.horticulturecertificates.com/

OMAFRA Factsheets

Reducing Pesticide Drift and Crop Damage,

Order No. 88-118

Pesticide Contamination of Farm Water Supplies,

Order No. 00-099

Ways to Avoid Pesticide Spills, Order No. 96-025

Farm Pesticide Storage Facility, Order No. 07-059

Field Sprayer Calibration, Order No. 88-129

Six Elements of Effective Spraying in Orchards and Vineyards,

Order No. 09-039

How Weather Conditions Affect Spray Applications,

Order No. 09-037W (web only)



3. USING PESTICIDES IN ONTARIO

**Read the latest product label
before using a pesticide!**

**Review the Grower Pesticide
Safety Course Manual.**

Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) and be classified under the provincial *Pesticides Act*. The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticides for use in Canada following an evaluation of scientific data to ensure that the product has merit and value. It also ensures that the human health and environmental risks associated with its proposed use are acceptable.

The PMRA re-evaluates registered pesticides to determine whether today's health and environmental protection standards are still met when following the label directions. Outcomes of a re-evaluation can be:

- no change in the registration
- label amendments (i.e. changes to personal protective equipment requirements, re-entry intervals and buffer zones)
- modifications to existing maximum residue limits (MRLs)

- elimination or phasing-out of certain uses or formulations
- no further acceptance of the registration

The pesticide label is a legal document. It prescribes how the pesticide can be legally used. Off-label use is prohibited. It is against the law to use the pesticide in any other way or on any other crop or pest than as specified on the label. Labels for all registered pesticides are under Label Search on the PMRA website at www.pmrara.gc.ca. Ensure you have the most current label and are aware of any re-evaluation decisions.

Regulation of Pesticides in Ontario

The Ministry of the Environment (MOE) is responsible for regulating the sale, use, transportation, storage and disposal of pesticides in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09. All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at www.e-laws.gov.on.ca or by calling Service Ontario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOE the classification of pesticide products before they

can be sold or used in Ontario. Pesticide products are classified on the basis of their toxicity, environmental or health hazard, persistence of the active ingredient or its metabolites, concentration, usage, federal class and registration status. This classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. Once approved by the MOE, classified products are posted on the MOE website at www.ene.gov.on.ca.

**The Ontario pesticide classification system
changed from 6 Schedules to 11 Classes
(Regulation 63/09).**

Certification and Licensing

Growers and their Assistants

For information about certification for growers and training for assistants to growers, visit the Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

Commercial Applicators (Exterminators) and their Assisting Technicians

For more information about exterminator licensing and technician training, visit the Ontario Pesticide Training & Certification website at www.ontariopesticide.com/OPTC/default.htm or call 1-888-620-9999 or 519-674-1575.

For more information about pesticide regulations, certification and licensing see:

- Inside front cover of this publication
- Pest Management Regulatory Agency (PMRA) website: www.pmr-arla.gc.ca
- PMRA Pest Management Information Service: 1-800-267-6315 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment (MOE) website: www.ene.gov.on.ca
- Regional MOE Pesticides Specialist (See Appendix D. *Ontario Ministry of Environment – Regional Offices Contact Information*, on page 350)
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website: www.ontario.ca/omafra
- Ontario Pesticide Education Program (University of Guelph Ridgetown Campus) website: www.opep.ca
- Ontario Pesticide Training & Certification website: www.ontariopesticide.com/OPTC/default.htm

Pesticide Application Information

When you decide to use a pesticide, choose the most appropriate formulation and application method for your situation. Use only a properly calibrated sprayer. Choose less toxic alternatives when possible. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide. Read the most current pesticide label thoroughly before application. The label provides important information, such as:

- directions for use (rates of application, crops it can be used on, target pests, crop rotation restrictions, total number of applications, droplet size/nozzle type, application equipment, timing and ideal weather conditions)
- required personal protective equipment
- health hazards and toxicity
- re-entry intervals
- buffer zones
- special warnings
- steps to be taken in case of an accident
- disposal

For more information on hazards, consult the Material Safety Data Sheet (MSDS) or contact the manufacturer.

Re-Entry Intervals

The re-entry interval, also referred to as Restricted Entry Interval (REI), is the period of time following a pesticide application during which workers must not enter the treatment area without wearing protective clothing and personal protective equipment. This allows any pesticide residue and vapours to dissipate from the treatment location (e.g. field), preventing the possibility of inadvertent pesticide exposure.

The PMRA reviews each pesticide to determine whether the label should include a specific re-entry interval. If the re-entry interval is not stated on the label, assume that the spray solution must be dry before re-entry can occur. Some pesticides have labels that carry a warning about working in treated crops. Follow the label recommendations.

Days to Harvest for Food Crops (Preharvest Intervals, Pregrazing and Feeding Intervals)

These intervals state the minimum time that must pass between the last pesticide application and the harvesting of the crop, or the grazing or cutting of the crop for livestock feed. If you harvest a crop before the preharvest interval (PHI) has passed, there may be pesticide residues in excess of the maximum residue limits (MRLs) set by PMRA.

To avoid exceeding the maximum residue limits, always follow the directions on the label.

Buffer Zones

Buffer zones are areas left untreated to protect an adjacent sensitive area, such as sensitive terrestrial and aquatic habitats, well heads, non-target crops and areas where children play.

Leave a suitable buffer zone between the treatment area and adjacent sensitive areas. Buffer zones may vary depending on the method of application (i.e. aerial, field boom, hand-held sprayer). Some pesticide labels specify buffer zone requirements. Check the pesticide label for the type of buffer zone required.

Sensitive terrestrial habitats include hedgerows, grasslands, shelterbelts, windbreaks, forested areas, woodlots, vegetative strips, etc.

Sensitive aquatic habitats include lakes, reservoirs, streams, creeks, ditches, marshes, wetlands, ponds, commercial fish ponds, etc.

Setback Distances for Water Bodies

It is an offence under the federal *Fisheries Act* to introduce into water any material that may be harmful to fish or fish habitat. To protect these waters, applicators must determine a suitable setback distance between the area to be protected and the area where pesticide treatments are planned (if one is not specified on the pesticide label). The protected area includes the water body as well as adjacent riparian (riverbank) areas that contribute to fish food and habitat.

Protect the Environment

Protect Water Sources

According to the British Crop Protection Council (BCPC), between 40 and 70% of surface water pesticide contamination comes from mixing and filling areas.

You should load or mix pesticides on impermeable surfaces that are safely away from watercourses or environmentally sensitive areas. Drainage and run-off should be collected and disposed of safely (*Your Guide to Using Pesticides*, BCPC 2007).

Clean your spray equipment away from wells, ponds, streams and ditches. Apply the diluted rinse water (usually at a ratio of 10 to 1) to the treatment area (crop) but do not exceed the pesticide rate recommended on the label.

Do not make a direct connection between any water supply (e.g. public supply, wells, watercourse or pond) and a spray tank. Use an anti-backflow device or intermediate system to prevent back-siphoning that could contaminate the water supply.

Immediately contain and clean up any spills to prevent contamination to water sources.

Check the pesticide label for specific instructions on water source protection.

For more information on protecting water sources, see:

- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies: Recommendations on Avoidance, Cleanup and Responsibilities*, Order No. 00-099
- OMAFRA Factsheet *Groundwater – An Important Rural Resource: Protecting the Quality of Groundwater Supplies*, Order No. 06-115
- OMAFRA/Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13

Prevent Bee Poisoning

It is important to protect bees when spraying insecticides. Honeybees, as well as other bees and insects, are important pollinators of crops. Many crops also offer bees sources of nectar for honey production.

Read each pesticide label for specific precautions regarding bees. Choose less toxic alternatives when possible. Most organophosphate and carbamate insecticides are highly toxic to bees.

Advise local beekeepers before you apply a pesticide, so that they may take additional precautions to protect their bees. Contact the Provincial Apiarist at 1-888-466-2372, ext. 63595, for a list of the beekeepers in your area. Follow guidelines regarding spray timing to prevent unnecessary poisonings. For more information on preventing bee poisoning, see the “apiculture” section of the OMAFRA website at www.ontario.ca/crops.

Manage Drift

- Do not spray when wind speeds are high or gusty. These conditions will favour spray drift. Check

pesticide labels for allowable wind speeds for spraying applications. Some labels may not provide this specific information. Constantly monitor wind conditions during spraying using a good quality wind meter. Record the wind speed and direction. As wind conditions change, you may need to make adjustments to further reduce the drift potential, such as adjusting water volume upwards, minimizing nozzle-to-target distance, changing nozzle technology, changing fields because of surrounding influences or stop spraying until conditions improve.

- Do not spray during periods of dead calm. Periods of dead calm usually occur in early morning or late evening, at which time the temperature is usually cooler and the relative humidity is typically higher. The combination of these factors can result in drift-sized droplets staying in the field. When the wind picks up, these spray droplets can move away from the target area, possibly causing injury to adjacent non-target areas.
- Use the recommended sprayer output (water volume).
- Use a nozzle that will produce the appropriate droplet size if specified on the pesticide label.
- Use the most appropriate nozzle for the type of application. Where practical, use air induction/venturi nozzles, which significantly reduce drift when compared to conventional nozzles.
- Check the height of the boom to the target and minimize the distance as much as possible while still maintaining spray uniformity.
- Follow buffer zone requirements for the protection of adjacent sensitive areas as outlined on the pesticide label.

- Use spray plume protection where practical or available (hoods, shrouds, screens and air curtains).
- Use drift-reducing adjuvants in the spray tank as directed on the label.
- Use wick weeders instead of spraying when possible.
- Use non-volatile pesticide formulations or products.

For more information about spray drift, see:

- OMAFRA/Agriculture and Agri-Food Canada booklet *Best Management Practices – Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph Ridgetown Campus) videos *How to Manage Spray Drift and Spray Drift Reduction Through Air Induction*, available at www.opep.ca/Educational/EducationalMaterials.htm

Pesticide Disposal

Empty Pesticide Containers

Never reuse empty containers. Puncture the cleaned empty containers to make them unusable.

The Ontario Empty Pesticide Container Recycling Program is available to growers and commercial applicators. Through this program, you can return cleaned and triple rinsed plastic/metal pesticide containers (up to 23 L for plastic and 20 L for metal) to pesticide container depots located throughout the province. Remove the paper booklet from the pesticide container before recycling. To locate the closest pesticide container recycling depot, call the Ontario Pesticide Education Program

at 1-800-652-8573, your local dealer or municipality, or visit the CropLife Canada website at www.croplife.ca.

Surplus Spray Mix

The best way to dispose of any excess spray mix is to find other fields that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that crop.

If you cannot find another field to spray, dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. The diluted solution can be safely applied to the original treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest or surplus spray mix disposal.

Never re-spray the treated field with undiluted spray mix. Spraying an area twice will double the recommended pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Surplus Pesticides in Storage

Be sure to safely dispose of pesticides that you do not need or cannot use. Options for proper disposal include:

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original, unopened container.
- Hire a waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes. Look in the Yellow Pages of your telephone directory under Liquid Waste Removal.

- Check your local paper or visit the CropLife Canada website (www.croplife.ca) for upcoming Obsolete Pesticide Collection Days.
- Contact your municipality to see if any waste collection days are scheduled and verify whether quantities of agricultural pesticides will be accepted.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for storage facilities. The storage requirements that must be followed are dependent on which classes of pesticides you store.

For more information about storing pesticides, see:

- OMAFRA Factsheet, *Farm Pesticide Storage Facility*, Order No. 07-059
- OMAFRA/Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph Ridgetown Campus) Grower Pesticide Safety Course Manual, available at www.opep.ca/Educational/EducationalMaterials.htm

Pesticide Spills

If a pesticide spill causes, or is likely to cause, an adverse effect that is greater than that which would result from the proper use of the pesticide, you must notify the Ministry of the Environment Spills Action Centre at 1-800-268-6060 (24 hours a day, 7 days a week) and your municipality.

A spill is defined as a discharge of pollutant that is abnormal in quality or quantity, from or out of a structure, vehicle, or other container into the environment. An incident such as an overturned pesticide sprayer that results in the loss of the spray solution to the environment, is an example of a spill. A pesticide container that ruptures and leaks its contents is another example of a spill. The discharge or spraying of a pesticide in an unapproved area, commonly referred to as an over-spray, is also considered a spill.

Before you begin to clean up a spill of any nature, remember to protect yourself against pesticide exposure. Wear the proper protective clothing and personal protective equipment. If the spill occurs inside an enclosed area (e.g. a pesticide storage area or a vehicle during transport), ventilate the area first. Once you

have protected and/or removed yourself and other persons or animals from the spill site, take additional measures to stop the spill at the source and prevent it from spreading and/or contaminating watercourses. Specific precautions, emergency contact information and first aid procedures may be found on the label.

For minor spills, it may be possible to remediate the problem:

- **For a liquid spill** – Cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.
- **For a dust, granular or powder spill** – Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.

For major spills, it is essential to stop the spill from spreading. The cleanup guidelines above may not be appropriate for all spill situations. Once you have contained the spill, follow directions from the manufacturer and regulatory authorities on cleaning the contaminated area.

For information on preventing spills, see:

- OMAFRA Factsheet, *Ways to Avoid Pesticide Spills*, Order No. 96-025
- OMAFRA/Agriculture and Agri-Food Canada booklet *Best Management Practices – Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opec.ca/Educational/EducationalMaterials.htm

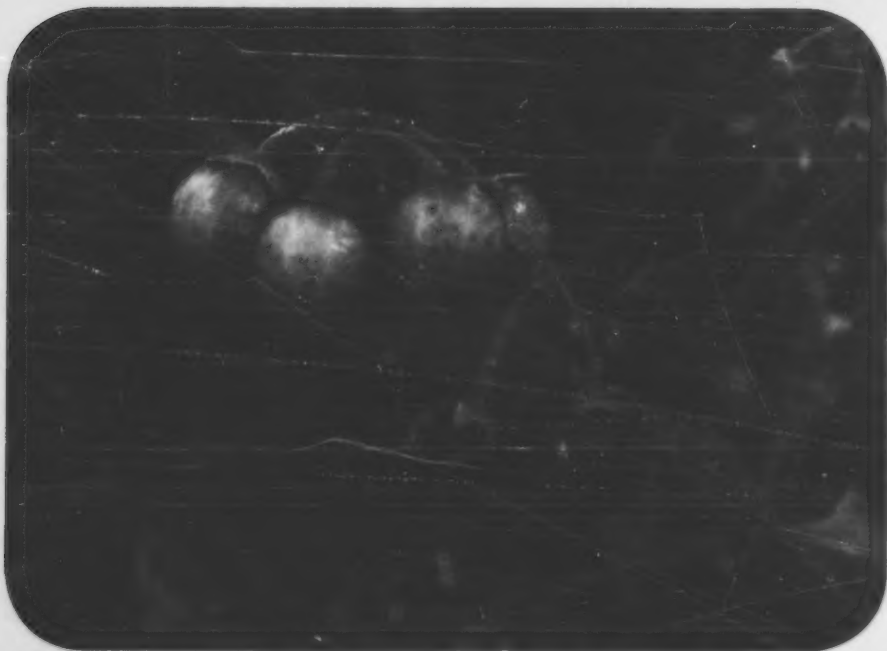
For pesticide poisonings and pesticide injuries call:

Poison Information Centre

1-800-268-9017

(TTY) 1-877-750-2233

For more information, see inside back cover on *Emergency and First Aid Procedures for Pesticide Poisoning*.



4. HERBICIDES USED IN ONTARIO

TABLE 4-1. Herbicides Used in Ontario

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classifi- cation	Manufacturer Agent Code
2,4-D	2,4-D AMINE 500	EC	470 g/L	4	A	4	UAG
2,4-D	2,4-D AMINE 600	EC	564 g/L	4	A	4	*
2,4-D	2,4-D ESTER 600	EC	564 g/L	4	C	3	INT, UAG
2,4-D	2,4-D ESTER 700	EC	660 g/L	4	C	3	*
2,4-DB	CALIBER 625	EC	625 g/L	4	B	3	UAG
2,4-DB	COBUTOX 625	EC	625 g/L	4	B	3	INT
2,4-DB	EMBUTOX	EC	625 g/L	4	B	3	NUA
2,4-D/dicamba/mecoprop-P	IPCO PREMIUM 3-WAY XP TURF HERBICIDE2	Sn	308 g/L	4	A	4	INT
2,4-D/dicamba/mecoprop-P	KILLEX 500	Sn	308 g/L	3	A	4	SGF
2,4-D/dicamba/mecoprop-P	PAR III	Sn	308 g/L	4	A	4	UAG
2,4-D/dicamba/mecoprop-P	PREMIUM 3-WAY	Sn	308 g/L	4	A	4	INT
2,4-D/dicamba/mecoprop-P	TRI-KIL	Sn	308 g/L	4	A	4	AGR
2,4-D/dicamba/mecoprop-P	TRILLION-P LIQUID TURF HERBICIDE	Sn	308 g/L	4	A	4	PLG
2,4-D/dicamba/mecoprop-P	WEEDAWAY PREMIUM 3-WAY XP TURF HERBICIDE	Sn	308 g/L	4	A	4	INT
acetic acid	ECOCLEAR	Li	25%	—	C	4	TIU
acifluorfen	BLAZER	Sn	240 g/L	14	B	3	UPI
aminopyralid	MILESTONE	EC	240 g/L	4	A	3	DWE
amitrole	AMITROL 240	SC	231 g/L	11	E	3	NUA
atrazine	AATREX LIQUID	Su	480 g/L	5	B	3	SYN
atrazine	CLEAN CROP ATRAZINE 480	Su	480 g/L	5	B	3	UAG
atrazine	CONVERGE 480	Su	480 g/L	5	B	3	BCZ
atrazine/2,4-D	SHOTGUN	Su	390 g/L	4,5	A	3	UAG
bensulide	BETASAN	EC	480 g/L	8	A	4	GOW
bentazon	BASAGRAN	Sn	480 g/L	6	B	4	BAZ
bentazon	BASAGRAN FORTÉ	Sn	480 g/L	6	A	4	BAZ

TABLE 4-1. Herbicides Used in Ontario (cont'd)

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classifi- cation	Manufacturer Agent Code
bentazon/atrazine	LADDOK	Su	(1:1) 400 g/L	5,6	A	3	BAZ
bromacil	HYVAR X-L	Sn	240 g/L	5	C	3	DUQ
bromacil/diuron	KROVAR	DF	(1:1) 80%	5,7	C	3	DUQ
bromoxynil	BROTEX	EC	240 g/L	6	C	3	INT
bromoxynil	KORIL	EC	235 g/L	6	C	3	NUA
bromoxynil	PARDNER	EC	280 g/L	6	C	3	BCZ
bromoxynil/MCPA	BADGE	EC	(1:1) 450 g/L	4,6	C	3	UAG
bromoxynil/MCPA	BUCTRIL M	EC	(1:1) 560 g/L	4,6	C	3	BCZ
bromoxynil/MCPA	LOGIC M	EC	(1:1) 450 g/L	4,6	C	3	INT
bromoxynil/MCPA	MEXTROL	EC	(1:1) 450 g/L	4,6	C	3	NUA
carfentrazone-ethyl	AIM EC	EC	240 g/L	14	B	3	NUA
carfentrazone-ethyl + glyphosate	CLEANSTART PLUS ¹ (AIM EC + CREDIT PLUS)	EC + Sn	240 g/L + 360 g/L	14,9	B	3	NUA
chlorimuron-ethyl	CLASSIC	DF	25%	2	C	3	DUQ
chlorimuron-ethyl + glyphosate	GUARDIAN (CLASSIC + TOUCHDOWN TOTAL)	DF + Sn	360 g/L + 25 DF	2,9	C,B	3,4	DUQ
chlorsulfuron	TELAR	DF	75%	2	C	3	DUQ
chlorthal dimethyl	DACTHAL W-75	DF	75%	3	C	4	UAG
clethodim	SELECT	EC	240 g/L	1	C	3	AVV
clomazone	COMMAND 360 ME	ME	360 g/L	13	B	3	UAG
clopyralid	LONTREL 360	Sn	360 g/L	4	A	3	DWE
clopyralid	TRANSLINE	Sn	360 g/L	4	A	3	DWE
cloransulam-methyl	FIRSTRATE	WG	84%	2	C	3	DWE
cooper sulphate	POLYDEX MC	MC	5%	—	A	4	ENR
corn gluten meal	TURFMAIZE	Gr	98%	—	C	4	ENF
dazomet	BASAMID	Gr	98%	27	C	3	BAZ
desmedipham/phenmedipham	BETAMIX	EC	(1:1) 150 g/L	7	B	4	BCZ
dicamba	BANVEL II	Sn	480 g/L	4	B	3	BAZ
dicamba	ORACLE	Sn	480 g/L	4	B	3	UAG
dicamba	VANQUISH	Sn	480 g/L	4	B	3	SYN
dicamba/atrazine	MARKSMAN	Su	393 g/L	4,5	B	3	BAZ
dicamba/atrazine	PROPERO	Su	393 g/L	4,5	B	3	SYN

TABLE 4-1. Herbicides Used in Ontario (cont'd)

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classifi- cation	Manufacturer Agent Code
dicamba/MCPA	DYVEL	Sn	(1:4) 420 g/L	4	B	3	BAZ
dicamba /MCPA/mecoprop-P/	SWORD	Sn	400 g/L	4	A	4	UAG
dicamba/MCPA/mecoprop-P	TARGET	Sn	400 g/L	4	A	4	SYN
dicamba/MCPA/mecoprop-P	TRACKER XP	Sn	400 g/L	4	A	4	INT
dichlobenil	CASORON 4G	Gr	4%	20	C	4	CRE
dichlorprop/2,4-D	DESORMONE	EC	680 g/L	4	B	3	NUA
dichlorprop/2,4-D	DICHLORPROP D	EC	(1:1) 582 g/L	4	B	3	INT
dichlorprop/2,4-D	DIPHENOPROP BK 700	EC	679 g/L	4	B	3	UAG
dichlorprop/2,4-D	ESTAPROP PLUS	EC	582 g/L	4	B	3	NUA
dichlorprop/2,4-D	TURBOPROP	EC	582 g/L	4	B	3	UAG
diflufenzopyr/dicamba	DISTINCT	WDG	70%	4,19	C	3	BAZ
dimethenamid	FRONTIER	EC	900 g/L	15	A	3	BAZ
dimethenamid-P	FRONTIER MAX	EC	720 g/L	15	A	3	BAZ
dithiopyr	D:MENSION	EC	120 g/L	3	B	3	DWE
diuron	DIUREX 80WDG	WP	80%	7	C	3	UAG
diuron	KARMEX	DF	80%	7	C	3	DUQ
diquat	REGLONE DESSICANT	Li	240 g/L	22	A	4	SYN
diquat (aquatic)	REWARD AQUATIC	Li	240 g/L	22	A	3	SYN
EPTC	EPTAM	EC	800 g/L	8	C	5	GOW
ethametsulfuron-methyl	MUSTER	DF	75%	2	C	3	DUQ
ethofumesate	NORTRON SC	Su	480 g/L	16	A	3	BCZ
fenoxaprop-p-ethyl	ACCLAIM SUPER	EC	80.5 g/L	1	A	3	BCZ
fenoxaprop-p-ethyl	EXCEL SUPER	EC	80.5 g/L	1	A	3	BCZ
fenoxaprop-p-ethyl/safener	PUMA ¹²⁰ SUPER	EC	120 g/L	1	A	3	BCZ
fenoxaprop-p-ethyl/safener	PUMA ADVANCE	EC	90 g/L	1	A	3	BCZ
flufenacet	DEFINE	DF	60%	15	C	3	BCZ
fluazifop-p-butyl	VENTURE L	EC	125 g/L	1	C	2	SYN
flumetsulam/metolachlor	BROADSTRIKE DUAL MAGNUM	SC	924.7 g/L	2,15	C	3	DWE
flumioxazin	BROADSTAR	Gr	25%	14	C	4	VAJ
flumioxazin	CHATEAU	WDG	51.1 %	14	C	4	VAJ
flumioxazin	PAYLOAD	WDG	51.1 %	14	C	4	VAJ

TABLE 4-1. Herbicides Used in Ontario (cont'd)

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classifi- cation	Manufacturer Agent Code
flumioxazin	SUREGUARD	WDG	51.1 %	14	C	4	VAJ
flumioxazin	VALTERA	WDG	51.1 %	14	C	4	VAJ
fluroxypyr	TROPHY A	EC	180 g/L	4	B	3	NUA
fomesafen	REFLEX	Sn	240 g/L	14	B	3	SYN
foramsulfuron + flufenacet	OPTION 1.2.3 ¹ (OPTION 2.25 OD + DEFINE)	OD + WG	22.5 g/L + 60%	2,15	C	4,3	BCZ
foramsulfuron	OPTION 2.25 OD	OD	22.5 g/L	2	C	4	BCZ
fosamine ammonium	KRENITE	Sn	480 g/L	27	B	4	DUQ
glyphosate	CATENA HERBICIDE	Sn	360 g/L	9	B	3	MOX
glyphosate	CREDIT 45	Sn	450 g/L	9	B	3	NUA
glyphosate	CREDIT PLUS	Sn	360 g/L	9	B	3	NUA
glyphosate	EZJECT	P	0.15 g/capsule	9	C	4	MOX
glyphosate	FACTOR	Sn	356 g/L	9	B	4	INT
glyphosate	FACTOR 540	Sn	540 g/L	9	B	4	INT
glyphosate	FORZA SILVICULTURAL HERBICIDE	Sn	360 g/L	9	B	4	CAU
glyphosate	GLYFOS	Sn	360 g/L	9	B	4	CAU
glyphosate	MAVERICK III	Sn	480 g/L	9	B	4	DOW
glyphosate	RENEGADE	Sn	356 g/L	9	B	4	MOX
glyphosate	RENEGADE HC	Sn	540 g/L	9	B	4	MOX
glyphosate	ROUNDUP ULTRA2	Sn	540 g/L	9	B	4	MOX
glyphosate	ROUNDUP WEATHERMAX	Sn	540 g/L	9	B	4	MOX
glyphosate	SHARPSHOOTER	SC	356 g/L	9	B	4	UAG
glyphosate	SHARPSHOOTER PLUS	Sn	360 g/L	9	B	4	UAG
glyphosate	TOUCHDOWN TOTAL	Sn	500 g/L	9	B	4	SYN
glyphosate	VISION	Sn	356 g/L	9	B	4	MOX
glyphosate	VISION MAX	Sn	540 g/L	9	B	4	MOX
glyphosate	VANTAGE	Sn	356 g/L	9	B	4	DOW
glyphosate	VANTAGE FORESTRY	Sn	356 g/L	9	B	4	DOW
glyphosate	VANTAGE PLUS	Sn	360 g/L	9	B	4	DOW
glyphosate	VANTAGE PLUS MAX	Sn	480 g/L	9	B	4	DOW
glyphosate	VANTAGE PLUS MAX II	Sn	480 g/L	9	B	4	DOW
glyphosate	WISE UP	Sn	356 g/L	9	B	4	ADJ

TABLE 4-1. Herbicides Used in Ontario (cont'd)

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classifi- cation	Manufacturer Agent Code
glyphosate/mesotrione/ s-metolachlor/benoxacor	HALEX GT	SC	525 g/L	9,27,15	B	3	SYN
glufosinate ammonium	IGNITE	Sn	150 g/L	10	A	4	BCZ
glufosinate ammonium	LIBERTY 200SN	Sn	200 g/L	10	A	4	BCZ
hexazinone	PRONONE	Gr	10%	5	C	4	DUQ
hexazinone	VELPAR	DF	75%	5	C	3	DUQ
imazapyr	ARSENAL	Sn	240 g/L	2	B	3	BAZ
imazethapyr	PURSUIT	Sn	240 g/L	2	A	3	BAZ
imazethapyr/pendimethalin	VALOR	Sn	342 g/L	2,3	A	3,2	BAZ
imazethapyr + bentazon	CLEANSWEEP ¹ (PURSUIT + BASAGRAN FORTÉ)	Sn + Sn	240 g/L + 480 g/L	2,6	A	3,4	BAZ
imazethapyr + metribuzin	CONQUEST LQ ¹ (PURSUIT + SENCOR 480F)	Sn + F	240 g/L + 480 g/L	2,5	C	3	BAZ
isoxaben	GALLERY	DF	75%	21	C	3	DWE
isoxaflutole	CONVERGE FLEXX	Su	240 g/L	27	B	2	BCZ
isoxaflutole + atrazine	CONVERGE XT ¹ (CONVERGE FLEXX + CONVERGE 480)	Su + Su	240 g/L + 480 g/L	5,27	B	2,3	BCZ
linuron	LOROX L	LiSu	480 g/L	7	A	4	TES
MCPA	MCPA AMINE 500	Sn	500 g/L	4	A	5	*
MCPA	MCPA AMINE 600	Sn	600 g/L	4	A	3	*
MCPA	MCPA ESTER 500	Sn	500 g/L	4	B	3	*
MCPA	MCPA ESTER 600	Sn	600 g/L	4	B	3	*
MCPA	MCPA SODIUM 300	Sn	300 g/L	4	A	4	*
MCPA	TROPHY B	Sn	500 g/L	4	B	3	NUA
MCPB/MCPA	CLOVITOX PLUS	Sn	375 g/L + 25 g/L	4	A	4	INT
MCPB/MCPA	TOPSIDE	Sn	400 g/L	4	A	4	UAG
MCPB/MCPA	TROPOTOX PLUS	Sn	400 g/L	4	A	4	NUA
mecoprop-P	COMPITOX	Sn	150 g/L	4	A	4	NUA
mecoprop-P	MECOPROP	Sn	150 g/L	4	A	4	UAG
mecoprop/2,4-D	TURF-RITE 2+2	Sn	(1:1) 400 g/L	4	A	4	AGR
mecoprop-P/2,4-D	IPCO PREMIUM 2-WAY XP TURF HERBICIDE	Sn	(1:1) 400 g/L	4	A	4	INT
mecoprop-P/2,4-D	MECOTURF PLUS 2,4-D	Sn	(1:1) 400 g/L	4	A	4	NUA

TABLE 4-1. Herbicides Used in Ontario (cont'd)

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classification	Manufacturer Agent Code
mesotrione	CALLISTO	SC	480 g/L	27	B	3	SYN
metam sodium	VAPAM	Sn	380 g/L	27	C	4	UAG
metribuzin	SENCOR 480 F	Su	480 g/L	5	C	3	BCZ
metribuzin	SENCOR 75 DF	WG	75%	5	C	3	BCZ
metribuzin	SENCOR SOLUPAK	WG	75%	5	C	3	BCZ
napropamide	DEVIRINOL 10G	Gr	10%	15	C	4	UAG
napropamide	DEVIRINOL 2G	Gr	2%	15	C	4	UAG
napropamide	DEVIRINOL DF	DF	50 DF	15	C	4	UAG
nicosulfuron	ACCENT	DF	75%	2	C	3	DUQ
nicosulfuron + prosulfuron + dicamba	ACCENT 1-PASS ¹ (ACCENT + PEAKPLUS)	DF + WG + Sn	75% + 75% + 480 g/L	2,4	C	3	DUQ
nicosulfuron + diflufenzopyr/dicamba	ACCENT TOTAL ¹ (ACCENT + DISTINCT)	DF + WG	75% + 70%	2,4	C	3	DUQ
nicosulfuron/rimsulfuron	ULTIM 75DF	DF	(1:1) 75%	2	C	3	DUQ
nicosulfuron/rimsulfuron + diflufenzopyr/dicamba	ULTIM TOTAL ¹ (ULTIM + DISTINCT)	DF + WDG	75% + 70%	2,4	C	3	DUQ
oxadiazon	RONSTAR 2G	Gr	2%	14	C	3	BCZ
oxyfluorfen	GOAL 2XL	EC	240 g/L	14	A	2	DWE
paraquat	GRAMOXONE	Sn	200 g/L	22	A	3	SYN
pendimethalin	PROWL 400	EC	400 g/L	3	A	2	BAZ
picloram/2,4-D	TORDON 101	Sn	(1:3.7) 305 g/L	4	A	3	DWE
prometryne	GESAGARD 480 SC	Su	480 g/L	5	B	3	SYN
propyzamide	KERB	WP	50%	15	C	3	DWE
prosulfuron + dicamba	PEAKPLUS ¹ (PEAK + BANVEL II)	WG+Sn	75% + 480 g/L	2,4	C	3	SYN
pyrasulfotole/bromoxynil	INFINITY	EC	256 g/L	27,6	C	3	BCZ
pyrazon	PYRAMIN FL	Su	430 g/L	5	B	4	BAZ
quizalofop-p-ethyl	ASSURE II	EC	96 g/L	1	A	3	DUQ
rimsulfuron	ELIM EP	DF	25%	2	C	3	DUQ
rimsulfuron	PRISM	DF	25%	2	C	3	DUQ
rimsulfuron + s-metolachlor/benoxacor + dicamba	BATTALION ¹ (ELIM + DUAL II MAGNUM + BANVEL II)	DF + EC + Sn	25% + 915 g/L + 480 g/L	2,15,4	B	3	DUQ

TABLE 4-1. Herbicides Used in Ontario (cont'd)

Abbreviations and column headings explained on page 30.

ACTIVE INGREDIENT	TRADE NAMES	Formulation	Guaranteed Active Concentration	Groups	Winter Storage	Classifi- cation	Manufacturer Agent Code
rimsulfuron + glyphosate	GALAXY ¹ (ELIM EP + ROUNDUP WEATHERMAX)	DF + Sn	25% + 540 g/L	2,9	C, B	3,4	DUQ
s-metolachlor + metribuzin	BOUNDARY	EC + WG	915 g/L + 75%	5,15	B	3	SYN
s-metolachlor/benoxacor	DUAL II MAGNUM	EC	915 g/L	15	B	3	SYN
s-metolachlor/benoxacor/atrazine	PRIMEXTRA II MAGNUM	SC	(1:0.8) 720 g/L	5,15	B	3	SYN
<i>Sclerotinia minor</i> strain IMI 344141	SARRITOR	Gr	300 CFU/g	—	—	3	SAR
sethoxydim	POAST ULTRA	EC	450 g/L	1	B	4	BAZ
simazine	PRINCEP NINE-T	WG	90%	5	C	3	SYN
simazine	SIMADEX	Su	500 g/L	5	A	3	BCZ
simazine	SIMAZINE 480	Su	480 g/L	5	A	3	UAG
terbacil	SINBAR	WP	80%	5	C	3	DUQ
thifensulfuron-methyl	PINNACLE	DF	75%	2	C	4	DUQ
thifensulfuron-methyl/ tribenuron-methyl	REFINE SG	SG	50%	2	C	3	DUQ
thifensulfuron-methyl/ tribenuron-methyl + MCPA	REFINE M ¹ (REFINE SG + MCPA ESTER 500)	SG	50%	2,4	C	3	DUQ
topramezone	IMPACT	SC	336 g/L	27	A	3	BAZ
tralkoxydim	ACHIEVE LIQUID	EC	400 g/L	1	B	4	SYN
triclopyr	GARLON 4	EC	480 g/L	4	B	3	DWE
triclopyr	RELEASE	EC	480 g/L	4	B	3	DWE
trifluralin	BONANZA 400	EC	400 g/L	3	B	4	UAG
trifluralin	RIVAL	EC	500 g/L	3	A	4	NUA
trifluralin	TREFLAN EC	EC	480 g/L	3	A	4	DWE
triflurosulfuron-methyl	UPBEET	DF	50%	2	C	3	DUQ

Footnotes

Mention of a brand or trade name in this table does not constitute a guarantee or warranty of the product by the Ontario Weed Committee. Neither does this use signify that these products are approved to the exclusion of the comparable products. All trade names are capitalized.

*Various manufacturers.

¹ Indicates herbicides sold as a co-pack under this trade name.

Formulation Abbreviations

DC = dispersible concentrate	F = flowable	OD = oil dispersible	Sn = solution
DF = dry flowable	Gi = gel	PE = pellets	SP = soluble powder
DG = dry granules	Gr = granular	PS = pressurized spray	Su = suspension (flowable)
DS = dry soluble	Li = liquid	SC = soluble concentrate	WG = wettable granules
EC = emulsifiable concentrate	ME = microencapsulated suspension	SG = soluble granules	WP = wettable powder
EM = emulsion			WDG = wettable dry granules

Winter Storage

- A – Do not allow to freeze.
- B – Preferably should not freeze. If frozen, return to original state by allowing product to warm to 10°C–20°C and agitate thoroughly before use.
- C – Not usually damaged by freezing. Store in a cool, dry place.
- D – Do not allow to freeze – store above 10°C.
- E – Do not allow to freeze – store above 4°C (this applies to the AMITROL 240).

Manufacturer Agent Code

See Appendix H. *Herbicide Companies and Agents*, on page 354. Phone numbers and websites are also listed.

TABLE 4-2. Description for Ontario Classification of Pesticide Product

Ontario Classification	Summary*
1	Designated under the <i>Pesticide Control Product Act</i> (PCPA) as pesticides of the Manufacturing Class for use only in the manufacture of a pest control product or a product regulated under the <i>Fertilizers Act</i> .
2,3,4	Designated under the <i>PCPA</i> as pesticides of the Commercial Class for use in commercial activities that are specified on the label or Restricted Class when the label specifies essential conditions respecting the display, distribution or limitations on the use of, or qualifications of persons who may use the product.
5,6,7	Designated under the <i>PCPA</i> as pesticides of the Domestic Class to be distributed primarily to the general public for personal use in or around their homes.
8	Banned for sale in Ontario.
9	Banned for use in, on or over land unless their use is excepted.
10	Are allowed for use under the promotion of public health or safety exception.
11	Require a "green" notice sign be posted for the purposes of providing public notice when products containing these ingredients are used by any person on non-residential area land and by a licensed exterminator on residential area land in performing land exterminations.

*Detailed descriptions of each classification can be found at: <http://www.ene.gov.on.ca/en/land/pesticides/class-pesticides.php>.

Notes on Herbicides

Read these notes together with the recommendations given later in this publication. Additional information on use, toxicity and safety precautions is given here. With a few exceptions, the herbicides are listed under their common (generic) rather than their trade or product name. See Table 4-1. *Herbicides Used in Ontario*, page 23, to determine the corresponding common name for a particular trade name. For example, Table 4-1 indicates that the trade name AATREX has a common name of atrazine; notes on AATREX are listed under atrazine in this section. See Chapter 5, *Notes on Adjuvants*, page 69, for information on adjuvants.

Complete information on each herbicide is available on the product label located on the herbicide container. The federal Pest Management Regulatory Agency also lists pesticide labels on their website www.pmr-arla.gc.ca. Many herbicide manufacturers also list product labels and/or Material Safety Data Sheets (MSDS) on their websites listed on the last page of this publication.

2,4-D

Trade Names: 2,4-D AMINE 500, 2,4-D ESTER 600, 2,4-D ESTER 700.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Cereals, turf, pastures, non-cropland, asparagus, field corn, cranberries, raspberries, strawberries, bearing fruit trees including apple, pear, peach, plum, apricot and cherries, water weeds and brush.

Sensitive Weeds: Most broadleaf weeds and brush.

Uptake and Translocation: Readily absorbed through leaves or roots. Translocated primarily in phloem with the sugars but can also move with water in the xylem. Accumulation is primarily in the young, rapidly growing meristematic regions of roots or shoots.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites lead to greater activity on broadleaf weeds compared to grasses.

Application Methods: Postemergence (broadleaf weeds), stem-foliage or stem-basal (brush).

Residual Activity: Half-life in soil is usually not longer than 1 or 2 weeks during the growing season due to rapid decomposition by soil micro-organisms.

Unique Characteristics: All weeds are more easily killed when growing rapidly in moist soil. Unfortunately, some broadleaf crops, garden and ornamental plants are as sensitive to 2,4-D as many weeds and only a trace of the chemical as spray drift, vapour drift or contaminant in soil or water may cause serious damage. Even crops that can be sprayed safely can be sensitive at some stages of growth or at excessive application rates; thus follow label precautions carefully. Amines and esters are the most common formulations of 2,4-D. The esters are the most active and can be used at the lower rates and for brush control. Since vapour drift is a potential problem with the ester formulations, use only amines on lawns, or near gardens or susceptible crop areas. Low-volatile esters can be used by agriculturists or licenced applicators in areas where risk of damage to sensitive non-target vegetation is low. Recommendations are on the basis of acid equivalent; commercial products differ in their content of acid equivalent, which must be considered in determining the amount of product to use.

2,4-D/DICAMBA/MECOPROP-P

Trade Names: KILLEX 500, PAR III, PREMIUM 3-WAY XP, TRI-KIL, TRILLION-P LIQUID TURF HERBICIDE, WEEDAWAY XP TURF HERBICIDE.

Chemical Family: Phenoxy/benzoic acid/phenoxy.

Crop and/or Non-Crop Registrations: Turf.

Sensitive Weeds: At field-crop rates: wild buckwheat, lady's-thumb, green smartweed, Russian thistle,

sow-thistle, hedge bindweed, corn spurry, knotweed, volunteer cultivated buckwheat, common ragweed, cocklebur, stinkweed, mustards, prostrate pigweed, redroot pigweed and lamb's-quarters. At non-cropland rates, a wide range of broadleaf weeds including bull thistle, chicory, goat's beard, ragwort, white cockle, poison-ivy, alder and sheep-laurel.

Application Method: Postemergence when weeds are small and actively growing.

Unique Characteristics: This mixture controls a wider spectrum of weeds than any of the herbicides alone.

2,4-DB

Trade Names: COBUTOX, EMBUTOX, CALIBER.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Seedling alfalfa, bird's-foot trefoil, clovers (except sweet) direct seeded or underseeded in spring wheat, barley or oats; corn.

Sensitive Weeds: Many small broadleaf weeds such as stinkweed, ragweed, lamb's-quarters, wild buckwheat and mustards. Top-growth control of Canada thistle, field bindweed and perennial sow-thistle.

Uptake and Translocation: Absorbed through the foliage and readily translocated to the growing points.

Basis of Selectivity: Sensitive weeds rapidly convert 2,4-DB into 2,4-D; tolerant species do not make this conversion under normal conditions.

Application Method: Postemergence.

Residual Activity: None.

Unique Characteristics: Mustards are not usually controlled by 2,4-DB alone if sprayed beyond the 4 leaf stage; a tank-mixture with MCPA will improve control of these larger mustards. Injury to alfalfa increases under drought stress or when alfalfa seedlings have more than 4 leaves.

ACETIC ACID

Trade Name: ECOCLEAR.

Chemical Family: Unknown.

Crop and/or Non-Crop Registrations: Non-crop, right-of-way and industrial land sites.

Sensitive Weeds: Annual broadleaf and grassy weeds including ragweed, chickweed, lamb's-quarters and black medic. Suppression of perennial weeds including dandelion, plantain spp., clover spp., wild carrot, toadflax, quack grass, tufted vetch, hawkweed spp. and curled dock.

Basis of Selectivity: Non selective.

Application Methods: Postemergence spray when weeds are small and actively growing. ECOCLEAR is a contact herbicide, thorough coverage is necessary to achieve desirable control. ECOCLEAR can be used as a spot treatment or as a broadcast application. For broadcast application apply 750–1,250 L of final solution/ha.

Residual Activity: Non-residual.

Unique Characteristics: ECOCLEAR works very quickly. Complete control can be achieved in as little as 24 hours. Weeds that are mature, dormant or hardened due to moisture stress tend to be more tolerant to treatment with ECOCLEAR.

ACIFLUORFEN

Trade Name: BLAZER.

Chemical Family: Diphenyl ether.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual broadleaf weeds including: cocklebur, jimsonweed, lady's-thumb, lamb's-quarters, wild mustard, redroot pigweed, common ragweed and Eastern black nightshade. Suppression of perennial weeds including: Canada thistle, hedge bindweed, field bindweed and common milkweed.

Uptake and Translocation: Taken up through the foliage. Not readily translocated.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence when weeds are small and actively growing. Apply in 200–400 L/ha of water with a pressure of 275–400 kPa. Soybeans are tolerant after the first trifoliate leaf stage.

Thorough coverage is necessary. The use of flat fan nozzles is recommended. Do not add adjuvants to acifluorfen applied at the full rate. BASAGRAN may be tank-mixed with acifluorfen for control of additional broadleaf weeds including velvetleaf. When tank-mixing BASAGRAN and acifluorfen, it is recommended to add 1 L/ha of ASSIST OIL CONCENTRATE.

Residual Activity: Essentially none.

Unique Characteristics: Acifluorfen is not volatile. Significant crop injury can be expected if acifluorfen is applied during hot, humid weather or if the crop is stressed due to previous herbicide injury, flooding, drought or cold conditions prior to the application. Cool weather or drought may delay control. Rainfall within 6 hours after application may reduce effectiveness. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

ADJUVANT

See Chapter 5, *Notes on Adjuvants*, page 69.

AMINOPYRALID

Trade Name: MILESTONE HERBICIDE.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Rangeland, grass pastures, industrial and other non-crop areas of Canada.

Sensitive Weeds: MILESTONE used alone controls: Canada thistle, spotted knapweed, Canada goldenrod, scentless chamomile, absinth wormwood, common tansy. MILESTONE can be tank mixed with 2,4-D amine for control of western snowberry, dandelion, annual sow thistle, bluebur, bull thistle, burdock, buttercup, cocklebur, common plantain, curled dock, flaxweed, goat's beard, hawkweed, hoary cress, peppergrass, perennial sow thistle, prickly lettuce, stinging nettle, sweet clover and wild carrot.

Uptake and Translocation: Herbicide taken up primarily through the foliage, but also has soil residual activity on roots, seedlings and seeds. Strong translocation.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Postemergence when weeds are small and actively growing. Apply with ground equipment in minimum of 100 L/ha or aerial equipment in a minimum of 19 L/ha spray volumes. Good coverage is necessary.

Residual Activity: Short term soil residual activity that will control most species for two years.

Unique Characteristics: MILESTONE has no grazing restriction on livestock or lactating dairy animals grazing in treated areas. Allow 3 days of grazing on untreated pasture or untreated hay before transferring livestock to areas where sensitive broadleaf crops may be grown. Do not move manure compost containing MILESTONE onto sensitive crops, flowers, gardens, etc. Use only on well established forage grasses (secondary root development). MILESTONE Herbicide will kill legume plants including alfalfa and clover in tame pastures. Use adequate buffer zones from sensitive crops and do not allow product spray to drift off site onto sensitive crops. Do not plant legumes crops on treated land for 48 months after application. Clean spray equipment thoroughly after use, before using spray equipment for other applications to sensitive crops. MILESTONE Herbicide cannot be applied on domestic or commercial turf grass. Rainfast period is 2 hours.

AMITROLE

Trade Name: AMITROLE 240.

Chemical Family: Triazole.

Crop and/or Non-Crop Registrations: Preplant in wheat, barley, canola, field peas, corn, soybeans and white beans. Postharvest after any crop. In-season weed control in apples. Use in shelterbelts, non-crop areas, marshes and ditches. Spot treatment in pastures.

Sensitive Weeds: Many annual and perennial broad-leaf weeds and grasses including quack grass, dandelions, Canada thistle, sow-thistle, poison-ivy, poison-oak, toadflax, milkweed, hoary cress, leafy spurge, horsetail, catrail, honeysuckle, locust, ash and sumac.

Uptake and Translocation: Absorbed by foliage and roots. Translocates well in xylem and phloem. Accumulates in growing regions of plant.

Basis of Selectivity: Resistant plants metabolize amitrole more rapidly than sensitive plants and may have lower uptake as a result of leaf structure that reduces wetting and penetration.

Application Methods: Foliar postemergence application to actively growing plants. Good coverage is essential. If weeds are mature, it is advisable to cut them and then spray the regrowth. Do not disturb treated plants for at least 2 weeks after application. Do not make postharvest application after Oct. 1. For control of quack grass and Canada thistle, apply in spring or fall to actively growing plants 15–20 cm tall; wait 10–14 days and then plough or disk.

Residual Activity: Approximately 2–4 weeks in moist, warm soil.

Unique Characteristics: Most crops are sensitive if contacted. Poor results may occur if spray coverage is inadequate, if plants are drought stressed or overmature, or if heavy rains fall within 6 hours after application. Do not graze or plant to grain, peas, alfalfa or clover for 8 months after treatment. Do not graze spot-treated areas in pastures for 6 months following treatment.

ATRAZINE

Trade Names: ATRAZINE 480, CLEAN CROP AATREX LIQUID 480, CONVERGE 480.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Corn (ensilage, field, seed and sweet), lowbush blueberries and triazine-tolerant canola (rapeseed).

Sensitive Weeds: Will control a wide range of broad-leaf weeds such as mustards, purslane, ragweed, smartweed, lady's-thumb, wild buckwheat, lamb's-quarters, pigweed and volunteer clover. Populations of lamb's-quarters, pigweed and ragweed have been found that are resistant to atrazine and are therefore not controlled.

Uptake and Translocation: Actively absorbed by roots and foliage, although foliar absorption is usually small. It is translocated to the top of the plant and accumulates in the leaf margins and the growing points.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: For corn, preplant incorporated, preemergence, or postemergence (with or without oil) usually before the annual weeds are more than 4 cm high; under dry weather conditions a shallow incorporation may enhance activity; oil or oil/surfactant blends will increase the postemergence activity. For lowbush blueberries, preemergence application. For triazine-tolerant canola, postemergence. Dry bulk fertilizer may be impregnated with atrazine and applied preplant incorporated. Atrazine may be tank-mixed with several other annual grass and broadleaf herbicides to increase the spectrum of weed control in corn.

Residual Activity: Can persist in the soil for varying lengths of time depending on rate, weather and soil conditions (longer under dry, cool weather conditions and in sandy soils). Postemergence treatments tend to persist longer than preemergence treatments. See section *Special Notes for Corn*, page 113.

Unique Characteristics: Atrazine may carry over for more than 1 planting season. One year after application there is usually no hazard to most rotational crops when 1.5 kg ai/ha or less is applied. Cool, dry weather and sandy soils are conditions under which problems may arise. See *Notes on Atrazine and Simazine Soil Residues*, page 113.

ATRAZINE/2,4-D

Trade Name: SHOTGUN.

Chemical Family: Triazine/phenoxy.

Crop and/or Non-Crop Registrations: Field corn.

Sensitive Weeds: Lady's-thumb, lamb's-quarters, wild mustard, redroot pigweed, common ragweed, velvetleaf, wild buckwheat; tank-mix with pendamethalin+rimsulfuron, nicosulfuron, rimsulfuron or nicosulfuron/rimsulfuron for control of barnyard grass, green foxtail and yellow foxtail; tank-mix with rimsulfuron or nicosulfuron/rimsulfuron for control of fall panicum.

Uptake and Translocation: Both components may be taken by either roots or shoots, but the atrazine will primarily be absorbed by the roots and travel in the transpiration stream, while the 2,4-D will primarily be absorbed by the shoots and move in the phloem.

Basis of Selectivity: See notes on 2,4-D and atrazine.

Application Method: Postemergence.

Residual Activity: Injury may occur if land treated with atrazine/2,4-D is planted to any crop other than corn in the same season. Sensitive crops such as tobacco and sugar beets should not be planted in the year following treatment. When extended periods of dry weather occur during the year of treatment, there can be some injury to succeeding crops such as white beans, onions, peas, tomatoes and turnips. Injury is most likely to occur when the seedling crop is subjected to periods of stress, e.g. during periods of abnormally hot, dry weather.

Unique Characteristics: See the 2,4-D note for information about spray and vapour drift. See also *Notes on Atrazine and Simazine Soil Residues*, page 113.

BENSULIDE

Trade Name: BETASAN.

Chemical Family: Benzenesulfonamide.

Crop and/or Non-Crop Registrations: Lawns, turf and cucumbers.

Sensitive Weeds: Germinating annual grasses such as annual bluegrass, barnyard grass, crab grass and

foxtail. Some control of redroot pigweed, lamb's-quarters and shepherd's-purse.

Uptake and Translocation: Adsorbed on root surfaces and a small amount is absorbed by the roots. Little or none is translocated upward to the leaves.

Basis of Selectivity: Inhibits root growth and partially inhibits cell division in sensitive seedlings. Sensitive species affected only in seedling stage. Metabolized by established grasses.

Application Methods: Preemergence in spring or fall for turf (well-established only); a higher rate is required for fall applications to control germinating weeds the following spring; incorporate by lightly irrigating into soil.

Residual Activity: Season-long weed control. Degraded slowly by soil micro-organisms with a half-life of 4–6 months depending on soil type. Because of soil residues, only cucurbits, cole crops, carrots, lettuce, peppers and tomatoes should be planted the following year.

Unique Characteristics: Bensulide is inactivated in soils containing high amounts of organic matter (muck soils). Incorporation recommended to avoid photodecomposition. Do not reseed turf within 1 year of application. Formulations available with fertilizers for homeowner lawn use.

BENTAZON

Trade Names: BASAGRAN FORTÉ, BASAGRAN.

Chemical Family: Benzothiadiazine.

Crop and/or Non-Crop Registrations: BASAGRAN FORTÉ AND BASAGRAN: Peas, flax, millet, sorghum, soybeans, corn. BASAGRAN also registered for peanuts, lima beans, highbush blueberries, new plantings of apples, apricots, cherries, peaches, pears and turf. BASAGRAN FORTÉ AND BASAGRAN are registered for use on a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations.

Sensitive Weeds: Annual broadleaf weeds including hairy nightshade, lamb's-quarters, redroot pigweed, low cudweed, purslane, common ragweed, wild radish, Russian thistle, hairy galinsoga, corn spurry, bird rape, flower-of-an-hour, buttercups, common groundsel, jimsonweed, giant ragweed, velvetleaf, lady's-thumb, wild mustard, cocklebur, stinkweed, shepherd's-purse and common chickweed. Triazine-tolerant biotypes of lamb's-quarters, redroot pigweed, common ragweed and common groundsel are also controlled. Top growth of Canada thistle and nut sedge are controlled. Field bindweed may be suppressed by two applications applied 10 days apart.

Uptake and Translocation: Taken up through the foliage. Not translocated.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence when weeds are small and actively growing. Apply in 100–400 L water/ha. Crop must be in a tolerant growth stage (see specific recommendations on label). Thorough spray coverage is necessary. Use flat fan nozzles tilted 45° forward. Use ASSIST OIL CONCENTRATE with BASAGRAN. Reduce the ASSIST rate under hot, humid conditions. Liquid ammonium sulphate or 28% urea ammonium nitrate may be added to BASAGRAN FORTÉ or BASAGRAN for improved and more consistent control of velvetleaf and lamb's-quarters in soybeans only. PINNACLE may be tank-mixed with BASAGRAN FORTÉ or BASAGRAN for improved pigweed and lamb's-quarters control in soybeans only. BASAGRAN FORTÉ does not require additional adjuvants. BASAGRAN FORTÉ is not registered for aerial application. BASAGRAN is registered for aircraft application for soybeans, dry and snap beans.

Residual Activity: Essentially none.

Unique Characteristics: Corn and turf are tolerant at all stages of growth. Bentazon is not volatile. Temporary crop injury can be expected if bentazon is applied during hot, humid weather or if crop is

stressed (flooding, drought, cold). Cool weather or drought may delay control. Rainfall within 6–8 hours after application may reduce effectiveness. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

BENTAZON/ATRAZINE

Trade Name: LADDOK.

Chemical Family: Benzothiadiazine/s-triazine.

Crop and/or Non-Crop Registrations: Corn (ensilage, field, seed and sweet).

Sensitive Weeds: Annual broadleaf weeds such as black nightshade, redroot pigweed, lamb's-quarters, low cudweed, purslane, common ragweed, Russian thistle, corn spurry, flower-of-an-hour, lady's-thumb, wild mustard, hairy galinsoga, bird rape, buttercup, common chickweed, common groundsel, jimsonweed, giant ragweed, velvetleaf and cocklebur. Triazine-tolerant biotypes are also controlled. Top growth of Canada thistle and nut sedge are controlled. Field bindweed may be suppressed.

Uptake and Translocation: Uptake into the plant occurs primarily through the leaves. Bentazon/atrazine has mainly contact action and translocation is minimal.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Apply Bentazon/atrazine early postemergence when weeds are small and actively growing. Apply in 200–400 L water/ha. Apply before weeds reach the maximum size listed on the label. This generally corresponds to corn in the 1–5 leaf stage. Under good growing conditions, the most effective time for spraying will usually be 18–28 days after planting. Add ASSIST OIL CONCENTRATE to the spray tank for all applications. Thorough spray coverage is important and use flat fan nozzles. The use of flooding nozzles is not recommended because of inadequate coverage.

Residual Activity: Injury may occur to any crop other than corn planted in the same season on land treated with bentazon/atrazine. In the season after

application, there is virtually no hazard to most rotational crops when label rates for annual weed control have been used. Overlap or the use of a double application for nut sedge control may result in injury to rotational crops due to carry over of the atrazine component of bentazon/atrazine.

Unique Characteristics: Corn is tolerant at all stages of growth. Rainfall within 6–8 hours of application may reduce effectiveness of the spray solution. Bentazon/atrazine is not volatile but it should not be applied when crop is under stress from prolonged cold, wet weather, poor fertility or other factors.

BROMACIL

Trade Names: HYVAR X-L.

Chemical Family: Uracil.

Crop and/or Non-Crop Registrations: Non-cropland for total vegetation control and as a spot treatment to control brush.

Sensitive Weeds: Annual and perennial broadleaf weeds and grasses (broadcast application). Several brush species (spot application).

Uptake and Translocation: Most readily absorbed through the roots. Surfactants can enhance foliar activity. Translocation is upward with the movement of water to leaves where it inhibits photosynthesis.

Basis of Selectivity: Non-selective at normal rates.

Application Methods: For herbaceous weeds, broadcast sprayed, preferably just before or during periods of active weed growth. For brush, spot applications with an exact-delivery handgun sprayer either at the base of target brush or on a grid.

Residual Activity: Half-life is 5–6 months for 4.4 kg/ha bromacil in a silty loam soil.

Unique Characteristics: Do not use Bromacil where it is likely to leach, wash or move with eroded soil into contact with the roots of desirable trees and shrubs. Do not apply to brush standing in water.

BROMACIL/DIURON

Trade Name: KROVAR.

Chemical Family: Uracil/substituted urea.

Crop and/or Non-Crop Registrations: Non-cropland.

Sensitive Weeds: Most herbaceous weeds.

Basis of Selectivity: Non-selective.

Application Method: Broadcast spray just before or during the period of active weed growth.

Unique Characteristics: Normally fewer species of weeds escape or regrow after use of this mixture compared to use of the same amount of either chemical alone. Also see notes on BROMACIL and DIURON.

BROMOXYNIL

Trade Name: BROTOX, KORIL, PARDNER.

Chemical Family: Hydroxybenzonitrile.

Crop and/or Non-Crop Registrations: Spring wheat, barley, oats, corn, fall rye, triticale, forage sorghum and millet, and many other grasses, garlic, dry bulb onions.

Sensitive Weeds: Smartweed, nightshade, velvetleaf, pigweed, common ragweed, cocklebur, stinkweed, and wild mustard are killed if the chemical thoroughly contacts these plants before they have more than four true leaves: wild buckwheat and lamb's-quarters control to eight leaf. Most established perennial broadleaf weeds, chickweed and grasses tolerate typical field rates of this herbicide.

Uptake and Translocation: Absorbed by plant foliage and moves very little within the plant.

Basis of Selectivity: Differential spray retention, uptake, translocation and degradation.

Application Method: Postemergence.

Residual Activity: Essentially no soil residual activity.

Unique Characteristics: Crop injury symptoms (leaf scorch) may develop if the plant is under stress within 2 or 3 days before or after spraying; this stress could be caused by high temperatures or high humidity or, in the case of corn, application following a period of cool, wet weather; such injury usually

does not affect yields. The formulation includes a wetting agent to improve the spread of droplets on the leaf. Although bromoxynil is not an effective soil-applied herbicide, broadleaf crops such as turnips, peas and beans should not be seeded for a week after spray application.

BROMOXYNIL/MCPA

Trade Names: BADGE, BUCTRIL M, LOGIC M, MEXTROL.

Chemical Family: Hydroxybenzonitrile/phenoxy.

Crop and/or Non-Crop Registrations: Spring and winter wheat, barley, oats, flax, fall rye, corn, timothy hay and canary grass.

Unique Characteristics: Combination of bromoxynil with MCPA provides better control of mustards than bromoxynil alone. Also see notes on BROMOXYNIL and MCPA.

CARFENTRAZONE-ETHYL

Trade Name: AIM EC.

Chemical Family: Aryl triazolinone.

Crop and/or Non-Crop Registrations: Preplant burn-down (all crops except tobacco, asparagus, ginseng, nursery stock and turfbeds); hooded sprayer applications (for use in root, tuber, bulb, legume, fruiting and leafy vegetables, pome and stone fruits and berries – refer to product label for specific crop registrations); harvest aid treatment for potatoes, dry beans, soybeans and cereals.

Sensitive Weeds: Broadleaf weeds.

Uptake and Translocation: Carfentrazone-ethyl is taken up through the foliage and not readily translocated.

Basis of Selectivity: Metabolism.

Application Methods: Coverage of the weeds is essential for good control. For dessication, apply when the crop is mature and the grain has begun to dry down.

Residual Activity: None.

Unique Characteristics: AIM EC is a non-residual product and will not injure subsequent crops.

CARFENTRAZONE-ETHYL + GLYPHOSATE

Trade Name: CLEANSTART PLUS (co-pack of AIM EC + CREDIT PLUS).

Chemical Family: Aryl triazolinone + Amino acid.

Crop and/or Non-Crop Registrations: Preplant burn-down (all crops except tobacco, asparagus, ginseng, nursery stock and turfbeds).

Sensitive Weeds: Annual and perennial broadleaf and grass weeds.

Uptake and Translocation: Refer to notes on carfentrazone-ethyl alone and glyphosate alone.

Basis of Selectivity: Refer to notes on carfentrazone-ethyl alone and glyphosate alone.

Application Methods: Refer to notes on carfentrazone-ethyl alone and glyphosate alone.

Unique Characteristics: Refer to notes on carfentrazone-ethyl alone and glyphosate alone.

CHLORIMURON-ETHYL

Trade Name: CLASSIC.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Common ragweed, redroot pigweed, and velvetleaf.

Uptake and Translocation: Following foliar application, chlorimuron is rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert chlorimuron to non-phytotoxic metabolites.

Application Methods: Postemergence.

Residual Activity: Chlorimuron-ethyl will provide some limited residual activity after application.

Unique Characteristics: A non-ionic surfactant must be added at 0.2% v/v. 28% Urea ammonium nitrate

(U.A.N.) at 2 L/ha will improve the control of velvetleaf. Typical symptoms of plant death (chlorosis, necrosis) may occur from 1–3 weeks after application, depending on growing conditions. Favourable growing conditions will speed the activity while cool or dry conditions will delay activity.

CHLORIMURON-ETHYL + GLYPHOSATE

Trade Name: GUARDIAN.

Chemical Family: Sulfonylurea, Amino acid.

Crop and/or Non-Crop Registrations: Preplant to soybeans. Postemergence only to glyphosate tolerant "Roundup Ready" soybean varieties.

Sensitive Weeds: Refer to Chlorimuron-ethyl alone and glyphosate alone.

Uptake and Translocation: Refer to Chlorimuron-ethyl alone and glyphosate alone.

Basis of Selectivity: Refer to Chlorimuron-ethyl alone and glyphosate alone.

Application Methods: See Crop Registrations.

Residual Activity: Chlorimuron-ethyl will provide residual activity of sensitive broadleaf weeds after application.

Unique Characteristics: The addition of a non-ionic surfactant is not required when chlorimuron-ethyl is tank-mixed with glyphosate.

CHLORSULFURON

Trade Name: TELAR.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Non-cropland.

Sensitive Weeds: Annual and perennial broadleaf weeds such as wild carrot, Canada thistle, sow-thistle, scentless chamomile, lamb's-quarters, wild mustard, redroot pigweed, stinkweed, cow cockle, chickweed and Russian thistle.

Uptake and Translocation: Thoroughly systemic after absorption of either foliage or roots. Foliar absorption is rapid.

Basis of Selectivity: A disruption of amino acid metabolism leads to an inhibition of cell division in sensitive plants. Faster rates of metabolic detoxification have been observed in tolerant species.

Application Methods: Preemergence or early postemergence.

Residual Activity: Half-life is 4–6 weeks under growing season conditions. Degradation is faster with higher soil temperatures and/or lower soil pH.

Unique Characteristics: Although degradation is moderately rapid, extremely low residues can be highly toxic to some broadleaf weeds, such as wild carrot, for up to 2 years after application. Use of this product requires a surfactant.

CHLORTHAL DIMETHYL

Trade Name: DACTHAL W-75.

Chemical Family: Phthalate.

Crop and/or Non-Crop Registrations: Broccoli, Brussels sprouts, cabbage, cauliflower, dry and snap beans, eggplant, established ornamentals, garlic, turf, onions, peppers, potatoes, seeded melons, soybeans, strawberries, sweet potatoes, tomatoes, woody nursery stock.

Sensitive Weeds: Germinating annual grasses and certain annual broadleaf weeds such as lamb's-quarters, purslane, common chickweed, redroot pigweed, carpetweed and groundcherry.

Uptake and Translocation: Absorbed by roots but not foliage. Does not translocate within the plant.

Basis of Selectivity: Inhibits growth of germinating seeds; exact mechanism not yet known.

Application Method: Must be applied prior to weed seed germination. Depending on the crop, may be applied preplant incorporated, preemergence, postemergence or post transplant to crop. At least 1 cm of water as either rain or irrigation is necessary to activate the herbicide. In turf, spring or fall application is satisfactory.

Residual Activity: Average half-life is 100 days in most general soil types. Effective weed control may be

maintained for as long as 2 months, depending on application rate and soil type.

Unique Characteristics: May be applied over the top of most plants with no phytotoxic effects. Has little herbicidal activity on velvetleaf, common ragweed, wild mustard, jimsonweed, galinsoga, smartweed, nutsedge and cocklebur. Established turf fields (with the exception of the bent grasses) have good tolerance. Turf should not be reseeded for 60 days after treatment. Use only on mineral soils.

CLETHODIM

Trade Name: SELECT.

Chemical Family: Cyclohexanedione.

Crop and/or Non-Crop Registrations: Canola, flax, a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations, soybeans, sunflowers, dry onions, and potatoes.

Sensitive Weeds: Annual grasses (wild oats, green and yellow foxtail, volunteer cereals, volunteer corn and barnyard grass).

Uptake and Translocation: Uptake through the foliage and translocated through both the phloem and xylem throughout the plant accumulating in the meristemic regions both above and below the ground.

Basis of Selectivity: Tolerant plants rapidly metabolize clethodim to several conjugated metabolites.

Application Method: Postemergent to actively growing grasses in the 2-6 true leaf stage.

Residual Activity: Rapid degradation in both soil and water with no soil activity.

Unique Characteristics: Highly active on all annual grasses and volunteer cereals at one low dose rate of 0.19 L/ha in a tank-mix with the adjuvant CC-16255.

CLOMAZONE

Trade Names: COMMAND 360 ME.

Chemical Family: Isoxazolidinone.

Crop and/or Non-Crop Registrations: Soybeans, sweet potatoes.

Sensitive Weeds: Velvetleaf, lambsquarters, lady's-thumb, Eastern black nightshade, barnyardgrass, green foxtail, yellow foxtail.

Uptake and Translocation: Primarily absorbed through the roots and is translocated through the xylem in the plant.

Basis of Selectivity: Clomazone is metalized in soybeans.

Application Methods: Preemergence.

Residual Activity: When applied at recommended rates, Command 360 ME will provide season long weed control. It is relatively immobile in soil and microbial decomposition is the principle path of dissipation. Some rotational restrictions apply, refer to Tables 4-4 and 4-5. *Herbicide Crop Rotation and Soil pH Restrictions*, on page 61, and page 63 for more information. Soil texture impacts residual and product efficacy, see product label for appropriate rates.

Unique Characteristics: Sensitive plants in the application zone will turn white (bleached) as carotenoid biosynthesis is inhibited.

CLOPYRALID

Trade Names: LONTREL 360, TRANSLINE.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Strawberries, highbush blueberries, new and bearing apples, cranberries, sugar beets, rutabagas, cole crops (cabbage, cauliflower, broccoli, asian cole crops), canola, barley, oats, wheat, control of broadleaf weeds in rights-of-way (hydro, railroad, communication lines, pipelines) and associated stations, industrial manufacturing sites, storage sites and roadsides, airports, military bases and low maintenance, rough-turf areas, rangeland, grass pasture and balsam fir Christmas tree stands or plantations.

Sensitive Weeds: Will control or suppress certain annual and perennial weeds including Canada thistle, goldenrod, ox-eye daisy, tufted vetch, sheep sorrel,

dandelion and wild buckwheat, scentless chamomile, groundsel, ragweed, coltsfoot and spotted knapweed.

Uptake and Translocation: Rapidly absorbed by foliage and translocated readily throughout the plant via both xylem and phloem systems. Clopyralid is distributed throughout the plant to the meristem.

Basis of Selectivity: Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species.

Application Methods: Postemergence as a broadcast or selective foliar.

Residual Activity: Half-life in soil is less than 30 days under conditions that are favourable for microbial degradation. Little to no residual activity.

Unique Characteristics: Clopyralid has little to no activity on woody vegetation, except woody species of the legume family.

CLORANSULAM-METHYL

Trade Name: FIRSTRATE.

Chemical Family: Triazolopyrimidine sulfonanilide.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Common ragweed, giant ragweed, cocklebur, velvetleaf, and jimsonweed.

Uptake and Translocation: Absorption by roots, shoots and foliage. Translocation via the xylem and phloem and accumulation in the growing points.

Basis of Selectivity: Metabolism by soybeans. Inhibition of the acetolactase synthase (ALS) enzyme in susceptible plants followed by a rapid cessation of cell division and plant growth.

Application Methods: Preemergence in both conventional and conservation tillage systems or postemergence prior to the flowering stage of soybeans.

Residual Activity: Decomposition in soils is attributed primarily to microbial degradation. Some rotational cropping restrictions apply. Refer to Tables 4-4 and 4-5. *Herbicide Crop Rotation and Soil pH Restrictions*, on page 61, and page 63 for additional information.

Unique Characteristics: Do not apply to peat or muck soils. Preemergence or postemergence applications require an activating rainfall that moistens the soil to a depth of at least 5 cm in order to move FIRSTRATE into the weed germination zone. If adequate rainfall is not received within 7–10 days after application, a shallow cultivation or use of a rotary hoe is recommended. Do not apply when air temperature is near freezing or when freezing conditions are expected for several days following time of application. Extended cold, wet conditions or abnormally high soil moisture conditions during emergence and early crop development may cause injury symptoms on soybeans such as temporary yellowing of the leaves and/or crop stunting. Soybeans will quickly outgrow these symptoms once normal growing conditions resume. Postemergence application prior to full emergence of the first trifoliate leaf may cause temporary yellowing of soybeans. This effect is transient and has no effect on soybean yields. Postemergence application requires the addition of a non-ionic surfactant (Agral 90) and a liquid ammonium fertilizer (28-0-0 or 32-0-0). See label for details.

COPPER SULPHATE

Trade Name: POLYDEX MC – Contact manufacturer for more information.

CORN GLUTEN MEAL

Trade Name: TURFMAIZE.

Chemical Family: TURFMAIZE is a non-chemical product.

Crop and/or Non-Crop Registrations: Established Kentucky bluegrass.

Sensitive Weeds: Inhibits germination of smooth crabgrass and dandelion.

Uptake and Translocation: Not available.

Application Methods: Applied before smooth crabgrass and dandelion germination to established Kentucky bluegrass turf in the spring, late summer or fall.

DAZOMET

Trade Name: BASAMID.

Chemical Family: Dithiocarbamate.

Crop and/or Non-Crop Registrations: Field and greenhouse vegetable seedbeds for eggplant, lettuce, pepper and tomato; fall treatment only of tobacco greenhouse seedbeds; field and greenhouse seed and planting beds for annual flowers; turf seedbeds.

Sensitive Weeds: Most germinating weed seeds.

Uptake and Translocation: Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds.

Basis of Selectivity: Non-selective. Chemical must be completely dissipated from the seedbed before planting or injury may occur. Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds.

Application Methods: Apply granular product to a well-worked seedbed and incorporate evenly. Seal soil immediately after incorporation by rolling and flooding or by covering with heavy polyethylene plastic and sealing edges. After a waiting period of 10–40 days, depending on soil temperature, aerate the soil. Conduct a safety germination test before using treated soil. Do not use when soil temperature is below 6°C.

Residual Activity: Depends on the rate applied, soil moisture and soil temperature. The gases are toxic to all growing plants and a safety germination test must be carried out to determine that the soil is safe for planting.

Unique Characteristics: Also controls unencysted nematodes and soil fungi.

DESMEDIPHAM/PHENMEDIPHAM

Trade Name: BETAMIX.

Chemical Family: Phenylcarbamate.

Crop and/or Non-Crop Registrations: Sugar beets.

Sensitive Weeds: Pigweed species, lamb's-quarters, wild mustard, wild buckwheat, green and yellow fox-tail. Other weeds like ragweed species, nightshade

species, kochia, goosefoot and stinkweed will be controlled when application of desmedipham/phenmedipham is made following treatment with another preplant or preemergence herbicide.

Uptake and Translocation: Desmedipham/phenmedipham is readily absorbed by foliage where it inhibits photosynthesis in the chloroplasts of leaf cells.

Basis of Selectivity: Rapid metabolism in tolerant species.

Application Methods: Postemergence beginning at the 2 true leaf stage of sugar beets. Up to the 2–4 leaf stage of weeds depending upon species. Best control is exhibited on very small, actively growing weeds.

Residual Activity: Soil half-life of desmedipham is less than 1 month and of phenmedipham is 25–30 days.

Unique Characteristics: Desmedipham/phenmedipham may cause temporary growth retardation and/or chlorosis or tip-burn to sugar beets when applied to stressed plants. Normal growth is resumed in 10 days after application.

DICAMBA

Trade Names: BANVEL II, ORACLE, VANQUISH.

Chemical Family: Benzoic acid.

Crop and/or Non-Crop Registrations: Field corn, spring and winter wheat, spring barley, spring rye, oats, summer fallow and stubble, pastures, red fescue, lowbush blueberries and turf; non-crop areas such as roadsides, utility rights-of-way and railways.

Sensitive Weeds: Annual, perennial and biennial broad-leaf weeds and numerous brush species including conifers. Effective against velvetleaf, Canada thistle, field bindweed and various triazine-resistant broad-leaf weeds. Control is best when weeds are small and actively growing.

Uptake and Translocation: Readily absorbed by roots, stems or leaves and then translocated to other plant parts.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Preemergence or postemergence in field corn. For all other crops and non-crop uses, postemergence applications are recommended.

Residual Activity: Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at rates recommended for crop situations.

Unique Characteristics: Dicamba is often mixed with grass herbicides or with phenoxy herbicides to provide a broader spectrum of weed control. Spray drift is toxic to sensitive plants in the same manner as 2,4-D, thus similar precautions should be followed. Cold weather conditions and/or subsequent high rainfall after dicamba application may lead to temporary corn injury particularly on early-season hybrids in Eastern Ontario. There is also a possibility of dicamba vapour drift from treated plant foliage during high temperatures (in excess of 25°C). At higher rates, dicamba can be toxic to trees and shrubs having roots under the treated areas.

DICAMBA/ATRAZINE

Trade Name: MARKSMAN, PROPERO.

Chemical Family: Benzoic acid/s-triazine.

Crop and/or Non-Crop Registrations: Field corn.

Sensitive Weeds: Annual and biennial broadleaf weeds including triazine-resistant biotypes.

Application Methods: Postemergence until the standing height of the corn is 13 cm (5 leaf stage).

Unique Characteristics: Provides season long broadleaf weed control in corn. Provides excellent control of triazine-resistant broadleaf weeds and is particularly effective in controlling velvetleaf and other later-germinating deep-rooted annuals.

DICAMBA/MCPA

Trade Name: DYVEL.

Chemical Family: Benzoic acid/phenoxy.

Crop and/or Non-Crop Registrations: Barley, spring wheat, winter wheat and oats.

Unique Characteristics: Provides better control of mustards and hemp-nettle than dicamba alone. Also see notes on DICAMBA and MCPA.

DICAMBA/MCPA/MECOPROP-P

Trade Name: SWORD, TARGET, TRACKER XP.

Chemical Family: Benzoic acid/phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Spring wheat, barley, oats not underseeded to legumes, stubble fields and summer fallow.

Sensitive Weeds: At field-crop rates: wild buckwheat, cow cockle, lady's-thumb, green smartweed, mustards, hemp-nettle, Russian thistle, corn spurry, flaxweed, annual sow-thistle, shepherd's-purse, common ragweed, pigweeds, chickweed, lamb's-quarters, knotweed, volunteer rapeseed and sunflowers.

Application Methods: Postemergence when weed seedlings are in the 2-3 leaf stage, spring wheat and oats are in the 4-5 leaf stage and barley is in the 2-3 leaf stage. Use water carrier and apply at 100 L total spray mix/ha.

Unique Characteristics: This mixture controls a wider spectrum of weeds than any of the herbicide components used alone. Under certain conditions, this mixture may cause shortening of the straw of cereals but yield will not be affected. See also DICAMBA, MECOPROP-P and MCPA.

DICHLOBENIL

Trade Name: CASORON 4G.

Chemical Family: Benzonitrile.

Crop and/or Non-Crop Registrations: Cranberries, fruit trees, grapes, highbush blueberries, raspberries, container nursery stock, woody nursery stock, shelterbelts and non-crop areas.

Sensitive Weeds: Most weeds are susceptible to or suppressed by, dichlobenil including perennials, vetch and horsetail.

Uptake and Translocation: Absorbed by the roots and rapidly translocated upward in the plant.

Basis of Selectivity: Selectivity is based on physical separation between the dichlobenil vapour layer in the top 5 cm of soil and the established crop roots below this level.

Application Methods: Apply preemergence to the weeds, preferably in either fall or early spring.

Residual Activity: May persist and provide weed control for 2-6 months; higher rates and applications following use in previous year(s) may result in soil residues persisting for longer than 1 year.

Unique Characteristics: Although applied as a granular herbicide it kills by means of a vapour phase in the top soil profile. Weed roots take up the herbicide as they enter this zone. Do not apply dichlobenil during periods of high soil temperature, since loss of control will result due to volatilization of the herbicide.

DICHLORPROP/2,4-D

Trade Names: DESORMONE, DICHLORPROP D, DIPHENOPROP BK 700, ESTAPROP PLUS, TURBOPROP.

Chemical Family: Phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Spring and fall wheat and barley; perennial weed and brush control on non-cropland.

Unique Characteristics: Most properties of dichlorprop are very similar to those of 2,4-D. Chickweed, wild buckwheat, smartweed and some woody species are more sensitive to dichlorprop/2,4-D than to 2,4-D alone. Do not use on oats. See also 2,4-D.

DIFLUFENZOPYR/DICAMBA

Trade Name: DISTINCT.

Chemical Family: Semicarbazone/Benzoic acid.

Crop and/or Non-Crop Registrations: Field corn (silage and grain).

Sensitive Weeds: Redroot pigweed, common ragweed, lamb's-quarters, wild buckwheat, lady's-thumb and velvetleaf. Controls horsenettle and horsetail when tank-mixed with nicosulfuron/rimsulfuron. Control is best when weeds are actively growing.

Uptake and Translocation: Readily absorbed by roots, stems or leaves and then translocated to other plant parts.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Early postemergence to 6 leaf corn recommended.

Residual Activity: Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at registered rates.

Unique Characteristics: This product has a wider application window, a lower use rate and has better activity on perennial weeds than dicamba alone. Spray drift is toxic to sensitive plants in the same manner as 2,4-D, thus similar precautions should be followed. The auxin transport inhibitor, diflufenopyr, will also be active with other growth hormone herbicides such as 2,4-D and clopyralid and may cause crop injury if tank-mixed. Do not use additives such as oils, ionic surfactants, wetting agents, sticking agents, etc. Do not apply when there is a risk of severe drop in night temperature. Do not spray when temperatures are expected to exceed 27°C. Do not spray in high humidity or fog. Do not apply preemergence on sandy or sandy loam soils. Do not till or cultivate treated area for at least 7 days following application. Adding a non-ionic surfactant at 0.25% v/v plus liquid nitrogen fertilizer 28-0-0 at 1.25% is recommended under postemergence applications.

DIMETHENAMID-P

Trade Name: FRONTIER MAX.

Chemical Family: Chloroacetamide.

Crop and/or Non-Crop Registrations: Corn (field, seed and sweet), dry beans (kidney, otebo and white),

peanuts, soybeans, cabbage (transplanted), dry bulb onions and non-bearing grape vines.

Sensitive Weeds: Green and yellow foxtail, barnyard grass, fall panicum, witch grass, large and smooth crab grass, redroot pigweed, Eastern black nightshade, and tall waterhemp. Yellow nut sedge can be controlled with a preplant incorporated application.

Uptake and Translocation: Absorbed through shoots and roots of germinating grass and broadleaf weeds but primarily via plant coleoptile.

Basis of Selectivity: Not established.

Application Method: 1) preplant incorporated – incorporate with vibrating shank cultivator, harrow or other implement capable of giving uniform shallow incorporation into the top 5 cm of the soil within 7 days of planting; 2) preemergence – rainfall is needed within 10 days of application to achieve sufficient herbicide activation; 3) early postemergence (corn only) – apply at the spike to 3 leaf stage of corn and up to the 2 leaf stage of annual grass weeds.

Residual Activity: Provides season-long weed control. Length of residual activity depends upon soil and moisture factors, application rate and timing. Heavy rainfall following an incorporated treatment may reduce weed control.

Unique Characteristics: No recropping restrictions in the fall or spring application in corn or soybeans. Application flexibility; there are many tank-mix and sequential treatment options for broad-spectrum weed control in corn and soybeans in all tillage systems (zero tillage to conventional tillage). Mixes well with bulk liquid and dry fertilizers.

DIQUAT

Trade Name: REGLONE DESICCANT.

Chemical Family: Bipirydylum.

Crop and/or Non-Crop Registrations: Desiccation of canola (rapeseed), flax, dry beans, dry peas, mustard, sunflowers, soybeans, adzuki beans, legume seed crops. Vine killing of potatoes. Control of corn spurry in oats. Stale seedbed and inter-row weeding.

Sensitive Weeds: Any foliage contacted by diquat will be killed.

Uptake and Translocation: Rapidly absorbed by foliage. Limited translocation.

Basis of Selectivity: None.

Application Methods: Postemergence.

Residual Activity: Essentially none due to adsorption of chemical to soil particles.

Unique Characteristics: Must be used with clean (non-turbid) water as the soil particles in muddy water drastically reduce the effectiveness of diquat. Apply in weather conditions that will not promote drift. For aerial application suggested conditions for good application are moderate temperatures (less than 25°C), humidity (greater than 40%) and wind (3.6–10 kph). Do not apply in dead calm conditions or when temperature inversion is likely (e.g. morning or evening when warm air is rising from crop). To avoid spray drift, use flat fan or hollow cone nozzles and a pressure of 140–210 kPa. For aerial application point the nozzles back 130°–180°. For further information on aerial application see product label.

DIQUAT (AQUATIC)

Trade Name: REWARD.

Chemical Family: Bipirydylum.

Crop and/or Non-Crop Registrations: Aquatic weed control in still or flowing water in ponds, ditches, lakes and canals.

Sensitive Weeds: Coontail, Canada waterweed, pondweeds, milfoil and duckweed.

Uptake and Translocation: Contact desiccant with limited translocation.

Basis of Selectivity: None.

Application Methods: Postemergence. Apply when weeds are visible and are actively growing. It can be applied: with a boat bailer device that injects the chemical below the water surface; sprayed over the water surface; or poured directly from a container onto the surface.

Residual Activity: Quickly inactivated by adsorption to soil particles.

Unique Characteristics: Must be used with and applied on non-turbid water, as the soil particles in muddy water drastically reduce the effectiveness of the material. Do not use treated water for swimming or consumption by humans or animals for at least 24 hours. Do not use water for irrigation for 5 days after treatment. To avoid fish kills caused by oxygen depletion, treat only 1/4–1/3 of the area at a time. Avoid application or drift onto crops, lawns, grazing areas, ornamental plants and other desirable plants.

DITHIOPYR

Trade Name: DIMENSION.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Turf.

Sensitive Weeds: Crab grass.

Uptake and Translocation: Absorbed through the shoots and roots. Limited translocation.

Basis of Selectivity: Differential uptake, translocation and metabolism in sensitive seedling weeds versus established plants.

Application Methods: Preemergence or early postemergence up to the 3 leaf stage of crab grass.

Residual Activity: Effective weed control may be maintained for 3 months.

Unique Characteristics: Preemergence and early postemergence activity allows control of emerged plants and follow-up residual control of later germinating crab grass plants.

DIURON

Trade Name: KARMEK, DIUREX 80WDG.

Chemical Family: Substituted urea.

Crop and/or Non-Crop Registrations: Grapes, asparagus, gladioli, industrial sites, right-of-ways.

Sensitive Weeds: Annual and perennial grasses, pigweed, ragweed, wild carrot and dandelion. Perennial weed control at higher rates in non-crop areas.

Uptake and Translocation: Most readily absorbed by roots, less so by foliage. Translocated upward in the xylem.

Basis of Selectivity: Used only in deep-rooted crops that are well established.

Application Methods: Applied to crops as a preemergence or directed early postemergence spray, preferably before weed growth becomes dense. Better control of emerged weeds is obtained by the addition of a suitable surfactant. In non-crop areas, diuron may be sprayed anytime except when ground is frozen.

Residual Activity: At lower rates used in crops, residues last about a year and thus applications may be repeated annually. At higher non-crop rates, persistence may be more than 1 year.

Unique Characteristics: Do not use where it is likely to leach or wash into contact with the roots of desirable trees or shrubs.

EPTC

Trade Name: EPTAM.

Chemical Family: Thiocarbamate.

Crop and/or Non-Crop Registrations: Alfalfa, bird's-foot trefoil, flax, potatoes, sunflowers and annual flowers. EPTAM, are registered for use on a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations.

Sensitive Weeds: Annual grasses such as crab grass, barnyard grass, fall panicum, wild oats, green foxtail and yellow foxtail; yellow nut sedge; some annual broadleaf weeds such as corn spurry, lamb's-quarters, nightshade, pigweed and chickweed if conditions are favourable for germination and growth.

Uptake and Translocation: Uptake by underground plant parts (roots, hypocotyl and seed). Upward translocation to the growing tip.

Basis of Selectivity: Metabolized by tolerant species at the seed germination stage through enzymatic

breakdown of the chemical. Seed food reserves also permit seedling to outgrow chemical effect.

Application Methods: Preplant incorporated or postplant incorporated. May be applied using water or liquid fertilizers as the carrier. To prevent chemical loss and reduced weed control, EPTC should be uniformly incorporated in the soil by setting the incorporation equipment (i.e. tandem disks, field cultivator with sweep teeth, or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep, followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be on a dry soil surface.

Residual Activity: Applied in the spring preplant, EPTC provides season-long weed control with no soil residues the following year to prevent crop rotation.

Unique Characteristics: EPTC does not need rainfall to activate and will not leach significantly under heavy rainfall. Under unfavourable germination conditions, leaf crinkling or leaf sealing may be observed on certain crops but usually without adverse effects on yield. May be tank-mixed with metribuzin for additional broadleaf weed control in potatoes. May be tank-mixed with trifluralin for additional broadleaf weed control in beans (white, snap and kidney). See label for other tank-mix combinations and information on less conventional application methods.

ETHAMETSULFURON-METHYL

Trade Name: MUSTER.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Spring canola.

Sensitive Weeds: Wild mustard.

Uptake and Translocation: Following foliar application, is rapidly absorbed and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell

division and growth. Tolerant species rapidly convert etha-metsulfuron-methyl to non-phytotoxic metabolites.

Application Methods: Postemergence.

Residual Activity: Rapid soil microbial degradation.

Unique Characteristics: A non-ionic surfactant must be added. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on growing conditions.

ETHOFUMESATE

Trade Name: NORTRON.

Crop and/or Non-Crop Registrations: Sugar beets.

Sensitive Weeds: Chickweed, lamb's-quarters, kochia, redroot pigweed, Russian thistle, wild buckwheat, barnyard grass, large crab grass, foxtails and downy brome.

Uptake and Translocation: Readily absorbed by emerging shoots (grass coleoptile and broadleaf hypocotyl) and roots, and translocated readily to the foliage. Postemergence applications of ethofumesate are poorly absorbed by maturing leaves with a well-developed cuticle.

Basis of Selectivity: Tolerant species conjugate the herbicide, rendering it inactive.

Application Methods: Preplant incorporated, preemergence.

Residual Activity: Half-life of less than 5 to more than 14 weeks depending on soil temperature and moisture conditions. Half-life increases in cooler, drier soils.

FENOXAPROP-P-ETHYL

Trade Name: EXCEL SUPER, ACCLAIM SUPER.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: EXCEL SUPER – Asparagus, broccoli, cabbage, cauliflower, carrots, peas (field and processing), potatoes, canola (rape-seed), triazine-tolerant canola, soybeans, tomatoes. EXCEL SUPER is registered for use on a number

of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations. ACCLAIM SUPER – Lawns and turf.

Sensitive Weeds: Barnyard grass, green and yellow foxtail, crab grass, witch grass, wild proso millet, fall panicum, volunteer corn.

Uptake and Translocation: Uptake primarily through the leaves. Does not translocate significantly.

Basis of Selectivity: Differential metabolism by tolerant versus sensitive species.

Application Methods: Non-residual postemergence for the control of annual grasses (EXCEL SUPER: 1–6 leaf stage; ACCLAIM SUPER: 1–4 leaf stage plus three tillers). For best results, apply when weeds are young and actively growing. EXCEL SUPER – Do not apply if rainfall is expected within 1 hour of application. ACCLAIM SUPER – Do not apply if rainfall is expected within 3 hours of application.

Residual Activity: Essentially none.

Unique Characteristics: EXCEL can be tank-mixed with BASAGRAN FORTÉ and/or PINNACLE for broad-spectrum annual weed control in soybeans and dry beans only. If annual grasses are in the correct stage for application before broadleaf weeds have emerged, do not delay EXCEL SUPER application.

FENOXAPROP-P-ETHYL/SAFENER

Trade Name: PUMA ADVANCE, PUMA¹²⁰ SUPER.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: Spring wheat.

Sensitive Weeds: Wild oats.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence, apply to wild oats at the 1–6 leaf stage (plus three tillers) and prior to flag leaf emergence of spring wheat. For best results, apply when weeds are young and actively growing.

Residual Activity: Essentially none.

Unique Characteristics: PUMA¹²⁰ SUPER can be tankmixed with BUCTRIL M for broad-spectrum

annual broadleaf weed control in spring wheat. Treatment at the 3–4 leaf stage of crops and weeds usually combines maximum crop tolerance and weed susceptibility. Under stressed conditions and/or heavy crop canopy, earlier application will result in improved grassy weed control. PUMA¹²⁰ SUPER contains a safener which allows spring wheat to metabolize fenoxaprop-p-ethyl. Spraying spring wheat with a fenoxaprop-p-ethyl product not containing this safener (i.e. EXCEL SUPER) will severely injure spring wheat.

FLUAZIFOP-P-BUTYL

Trade Names: VENTURE L.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: Flax, canola, soybeans, sugar beets, sunflowers, tobacco, forage legumes (alfalfa, red clover and bird's-foot trefoil), cabbage, broccoli, Brussels sprouts, cauliflower, cucumber, onions, potatoes, rutabagas, tomatoes, lowbush and highbush blueberries, raspberries, strawberries, non-grassy ornamental plants, poplars, shrubs, trees, apples, apricots, cherries, cranberries, peaches, pears and plums, forest and ornamental nurseries.

Sensitive Weeds: Annual grass species, volunteer corn, wheat, barley and quack grass.

Uptake and Translocation: Absorbed primarily by leaves. Translocated to roots and rhizomes.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence. Apply when grasses are actively growing, and annual grasses are in the 2–5 leaf stage and quack grass is in the 3–5 leaf stage.

Residual Activity: Essentially none.

Unique Characteristics: Preplant tillage to break up rhizomes will improve control of quack grass. Except as noted on the label, apply broadleaf herbicides separately at least 3 days after fluzifop-p-butyl. Do not cultivate for 5 days after applying fluzifop-p-butyl. When plants are stressed (lack of moisture,

excessive humidity, low temperature and/or very low relative humidity), fluzifop-p-butyl is less effective. Regrowth by tillering may occur if application is made under any of the above conditions. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

FLUFENACET

Trade Name: DEFINE DF.

Chemical Family: Oxyacetamide.

Crop and/or Non-Crop Registrations: Corn (field).

Sensitive Weeds: Green foxtail, suppression of lamb's-quarter and redroot pigweed.

Uptake and Translocation: Flufenacet is absorbed through shoots (primarily coleoptile) and roots of germinating grasses and broadleaf weeds.

Basis of Selectivity: Metabolized by tolerant species.

Application Method: Postemergence from the spike to 3 leaf stage of corn.

Residual Activity: Residual soil activity by flufenacet will normally be maintained for approximately 21 days after application.

Unique Characteristics: DEFINE DF is sold only in a co-pack with OPTION 2.25 called OPTION 1.2.3. Do not use on muck soils or coarse textured soils with low organic matter.

FLUMETSULAM/S-METOLACHLOR

Trade Name: BROADSTRIKE DUAL MAGNUM.

Chemical Family: Triazolopyrimidine sulfonanilide/acetanilide.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Common lamb's-quarters, redroot pigweed, Eastern black nightshade, American nightshade, common ragweed, velvetleaf, cocklebur, barnyard grass, crab grass (smooth, hairy), foxtail (green, yellow, giant), fall panicum, witch grass, yellow nut sedge.

Uptake and Translocation: Flumetsulam and s-metolachlor are absorbed by both roots and shoots

of germinating broadleaf weeds. S-metolachlor is absorbed by germinating grasses mainly through the shoot just above the seed.

Basis of Selectivity: Selectivity of flumetsulam in soybeans is based on metabolism. Basis of selectivity of metolachlor not established.

Application Methods: Surface preplant, preplant incorporated or preemergence.

Residual Activity: The most significant means of dissipation of both s-metolachlor and flumetsulam is microbial degradation. Provides season-long residual control of annual broadleaf and grass weeds. Rotational crops are winter wheat, spring wheat, spring barley, soybeans, common beans (dry, snap), lima beans, peas, field corn, seed corn.

Unique Characteristics: Can be applied up to 21 days before planting. Rainfall within 7-10 days is required for maximum activity of a preemergence application. Do not apply to areas where the soil pH is more than 7.8 and organic matter is less than 2%. Do not apply to soils containing more than 5% organic matter. Suspension concentrate formulation separates into two phases over time. Shake container well before using.

FLUMIOXAZIN

Trade Name: BROADSTAR, CHATEAU, PAYLOAD, SUREGUARD, VALTERA.

Chemical Family: Dicarboxamide.

Crop and/or Non-Crop Registrations: Dry bulb onion, potato, pome fruit (apple and pear), grape, strawberry, highbush blueberry, stone fruit (peach, cherry, nectarine, plum and apricot), asparagus, container-grown woody ornamentals, soybeans and non-crop areas.

Sensitive Weeds: Hairy bittercress, liverwort, pigweed spp., common ragweed, lamb's-quarters, hairy nightshade, Eastern black nightshade. Suppression of green foxtail, common groundsel and common chickweed.

Uptake and Translocation: Primarily taken up by the roots of treated plants following soil applications. Movement in the phloem is limited because of the rapid foliar desiccation caused by the herbicide.

Application Methods: See label for specific timing in each registered crop. In general, flumioxazin must be applied prior to weed emergence.

Residual Activity: Generally will provide 4 to 6 weeks of broadleaf weed control, however the length of residual control is dependent on application rate, rainfall and temperature conditions following application.

Unique Characteristics: Flumioxazin is a soil applied herbicide providing residual control of annual broadleaf weeds and suppression of grassy weeds. Moisture is necessary for effective residual weed control. Dry weather following applications of flumioxazin may reduce effectiveness. Flumioxazin will not control emerged weeds and may not control weeds that germinate after application but before an activating rainfall or weeds that germinate through cracks resulting from dry soil. Disturbing soil surfaces may reduce efficacy.

FLUROXYPYR

Trade Name: TROPHY A.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Winter wheat

Sensitive Weeds: Cleavers, kochia, round-leaved mallow, volunteer flax. Suppression of chickweed, hempnettle, stork's bill and wild buckwheat.

Application Methods: Postemergence from the 3 leaf to flag leaf stage of winter wheat.

Residual Activity: Half life ranges from 11 to 38 days. Fluroxypyr provides very little residual weed control.

Unique Characteristics: This product was specifically brought to the Ontario marketplace for the control of cleavers in winter wheat. TROPHY A is one component of the TROPHY co-pack, the second component is TROPHY B (MCPA). Field

experience has shown that it also provides suppression of tufted vetch, an increasingly problematic species in Ontario.

FOMESAFEN

Trade Name: REFLEX.

Chemical Family: Diphenyl ether.

Crop Registrations: Soybeans, and is registered for use on a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations.

Sensitive Weeds: Redroot pigweed, common ragweed, wild mustard, lady's-thumb, black nightshade, cocklebur; suppression of velvetleaf, lamb's-quarters, tall waterhemp.

Uptake and Translocation: Taken up through foliage. Not readily translocated.

Mode of Action: Cell-membrane disrupter.

Method of Selectivity: Beans metabolize fomesafen. Some initial bronzing of crop leaves may occur, but plants normally outgrow this condition without any effect on maturity or yield.

Application Method: Early postemergence to weeds and crop. Apply when beans are 1–2 trifoliolate and weeds are at the 2–4 leaf stage. Good coverage is essential for optimum weed control. Apply in 200–350 L of water/ha at a pressure between 245–420 kPa. Always add an adjuvant such as AGRAL 90 (0.25% v/v) or TURBOCHARGE (0.5% v/v). PINNACLE or VENTURE may be tank-mixed for additional weed control.

Residual Activity: Persistence depends on weather and soil conditions (more persistent under dry conditions). Rotation to field corn, dry beans or soybeans the following year. Winter wheat may be planted 90 days after treatment. All other crops require a field bioassay.

Unique Characteristics: Do not apply REFLEX to any field more than once every 2 years.

FORAMSULFURON

Trade Name: OPTION 2.25 OD.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Field corn.

Sensitive Weeds: Quackgrass, green, yellow and bristly foxtail, fall panicum, proso millet, barnyard grass, old witchgrass, large crabgrass, redroot pigweed, common lamb's-quarters, velvetleaf, Eastern black nightshade, common chickweed, wild and wormseed mustard.

Uptake and Translocation: Foramsulfuron is quickly absorbed through leaves and rapidly translocated throughout the plant.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants. Tolerant species rapidly metabolize foramsulfuron.

Application Methods: Postemergent from the 1–8 leaf stage of corn, emerged grassy weeds up to the early tillering stage, emerged broadleaf weeds.

Residual Activity: Essentially none.

Unique Characteristics: Addition of the safener isoxadifen in the formulated product maximizes crop tolerance, enhances crop recovery under severe environmental conditions and allows the use of an ethylated/methylated seed oil based adjuvant system.

FORAMSULFURON + FLUFENACET

Trade Name: OPTION 1.2.3. (co-pack of OPTION 2.25OD + DEFINE DF. This co-pack must be tank-mixed with atrazine).

Chemical Family: Sulfonylurea + oxyacetamide.

Crop and/or Non-Crop Registrations: Corn (field).

Sensitive Weeds: Annual broadleaf weeds including lamb's-quarters, redroot pigweed, common ragweed, velvetleaf, wild buckwheat, lady's-thumb, wild mustard, annual sowthistle, Eastern black nightshade, green foxtail, yellow foxtail, witchgrass, barnyard grass and fall panicum. Suppression of annual grass weeds including large crabgrass and proso millet.

Uptake and Translocation: Refer to notes on foramsulfuron, flufenacet and atrazine.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Postemergence to corn (up to and including 3 leaf stage), when weeds are small and actively growing. Apply in a minimum volume of 150 L/ha with a pressure of 175–275 kPa.

Residual Activity: Residual soil activity by flufenacet will normally be maintained for approximately 21 days after application.

Unique Characteristics: OPTION 1.2.3. is sold as a co-pack of Option 2.25OD and Define DF Herbicide. The atrazine component is sold separately but is a necessary component of the tankmix. UAN (28%) should be added to the tank at a rate of 1L/ac (2.5 L/ha). OPTION 1.2.3. provides excellent season-long control of Fall Panicum.

FOSAMINE AMMONIUM

Trade Name: KRENITE.

Chemical Family: Carbamoyl phosphonate.

Crop and/or Non-Crop Registrations: Vine and brush control on non-cropland.

Sensitive Weeds: Blackberry, oak, pine, sumac, maple, elder, elm, wild rose, hazel, aspen and beech. Cedar and spruce are quite tolerant.

Uptake and Translocation: Absorption by young stems and foliage. Translocation has been observed from a treated mature leaf to all other parts of a plant but phloem transport with sugars is predominant.

Basis of Selectivity: Not highly selective.

Application Methods: Postemergence. Apply with high pressure ground equipment to ensure penetration of spray to thoroughly wet leaves, buds, stems and trunks of target brush. Surfactants are recommended to promote rapid leaf penetration.

Residual Activity: Essentially none.

Unique Characteristics: Woody plants treated with fosamine ammonium die very slowly; the stems may not be completely killed 2 years after treatment; the unsightly brown-out effect common to many other

herbicides does not occur. Rainfall within 24 hours of application may decrease effectiveness.

FUMIGANTS

See METAM SODIUM.

GLUFOSINATE AMMONIUM

Trade Name: IGNITE, LIBERTY 200SN.

Chemical Family: Unique.

Crop and/or Non-Crop Registrations: IGNITE – Desiccation of dry beans and potatoes; directed applications in apples, grapes, peaches, pears and plums; stale seedbed techniques in asparagus, carrots, lettuce and onions; ground crack application in potatoes. LIBERTY 200SN – Corn hybrids, soybean and canola varieties specially developed to be tolerant to Liberty 200SN herbicide. Glufosinate-ammonium tolerant inbred lines grown for seed corn production.

Sensitive Weeds: Non-selective – affects all actively growing green plants; regrowth of perennial species may occur.

Uptake and Translocation: Absorbed through foliage; minimal translocation – dependent on application rate and species treated.

Basis of Selectivity: IGNITE – All green plant tissue is sensitive; safe on mature (non-green) bark of woody plants. LIBERTY 200SN – All green plant tissue is sensitive except for field corn, seed corn and canola plants that have been specially developed to be tolerant.

Application Methods: IGNITE – Postemergence; broadcast or directed spray to avoid contact with leaves or green bark of desirable plants; thorough coverage of the plant tissue to be controlled is essential. LIBERTY 200SN – Postemergence. Can be broadcast in Liberty Link corn at the 1–8 leaf stage, apply with drop nozzles to later corn growth stages; cotyledon to flowering stage in Liberty Link

soybeans and cotyledon to early bolting stage in InVigor canola.

Residual Activity: None; there are no cropping or rotational restrictions after application.

Unique Characteristics: Speed of action is influenced by environmental factors; at cool temperatures, poor moisture and low humidity, speed of action may be reduced. Heavy dew at time of application may reduce control of certain weed species.

GLYPHOSATE

Trade Names: CATENA HERBICIDE, CREDIT 45, CREDIT PLUS, EZJECT, FACTOR, FACTOR 540 GLYPHOSATE, FORZA SILVICULTURAL HERBICIDE, GLYFOS, MAVERICK III, RENEGADE, RENEGADE HC, ROUNDUP ULTRA 2, ROUNDUP WEATHERMAX, SHARPSHOOTER, SHARPSHOOTER PLUS, TOUCHDOWN TOTAL, VANTAGE, VANTAGE FORESTRY HERBICIDE, VANTAGE PLUS, VANTAGE PLUS MAX, VANTAGE PLUS MAX II, VISION, VISION MAX.

Chemical Family: Amino acid.

Crop and/or Non-Crop Registrations: Preplant or post-harvest with no cropping restrictions. Preharvest in wheat, barley, soybeans, canola, flax, lentils, peas and forages. Roundup Ready Crops – refer to Table 4-3. *Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops*, page 60. Directed applications in ginseng, cherries, grapes, apples, pears, plums and peaches, strawberries as wiper or spot treatment. Non-crop registrations: Brush control; turf renovation; chemical mowing; directed application in woody nursery stock, roadsides and shelterbelts. E-Z-JECT – Selective woody brush and tree control. CATENA HERBICIDE, FORZA SILVICULTURAL HERBICIDE, VANTAGE FORESTRY HERBICIDE, VISION, VISION MAX – Silvicultural site preparation, conifer release, forest tree plantings, forest tree nurseries.

Sensitive Weeds: Annual grasses; perennial weeds (quack grass, Canada thistle, sow-thistle, field bindweed, milkweed, cattails, nut sedge, poison-ivy etc.); brush (birch, alder, poplar, raspberry, willow and maple).

Uptake and Translocation: Absorbed through foliage and translocated throughout the plant.

Basis of Selectivity: Non-selective for agricultural crops. Conifers are tolerant at some stages but the basis has not been established.

Application Methods: Postemergence, usually at the bud to bloom stage of growth for most perennial weeds. Canada thistle should be at least in early flower bud, milkweed at flower bud and bindweed at full flower. Quack grass can be treated in the spring or fall when it is actively growing with at least 3–4 new leaves on each emerged shoot; in the fall, remove crop refuse but do not till prior to application; fall or spring tillage prior to spring application may reduce control; wait at least 3–5 days after application before working the area; for maximum control it is advisable to till before the quack grass turns completely brown. Glyphosate can be applied with boom equipment, knapsack sprayers and high-volume equipment for agricultural and non-crop uses. Backpack mist blowers may be used for silvicultural site preparation and roadside brush control only. Aerial applications may be used for silvicultural site preparation and conifer release only. Can also be applied with selective equipment for non-crop areas, tree plantings, grapes and orchards (See *Pre-plane Weed Control*, page 81 and *Wick Wiper and Roller Application*, page 85). Regardless of method of application, do not allow herbicide solution to contact green foliage or green bark of crop or other desirable plants; remove all suckers from the trunks of desirable trees before spraying.

Residual Activity: None – crops can be planted or seeded directly into treated areas following application. Other herbicides are required to control weeds emerging after the application.

Unique Characteristics: Rainfall within 6 hours after application or heavy frost within 24 hours may reduce control for 356 g/L formulations. 360 g/L formulations are rainfast as soon as 4 hours after application. ROUNDUP ULTRA 2, ROUNDUP WEATHERMAX, FACTOR 540 and TOUCH-DOWN TOTAL are rainfast as soon as 1 hour after application.

GLYPHOSATE/MESOTRIONE/ S-METOLACHLOR/BENOXACOR

Trade Name: HALEX GT.

Chemical Family: Amino acid, triketone and acetanilide.

Crop and/or Non-Crop Registrations: Glyphosate tolerant (Roundup Ready) corn only.

Sensitive Weeds: Emerged annual grass and broadleaf weeds controlled by glyphosate and residual control of unemerged annual grass and broadleaf weeds (see residual activity for specific species).

Uptake and Translocation: Refer to glyphosate, mesotrione and s-metolachlor/benoxacor.

Basis of Selectivity: Refer to glyphosate, mesotrione and s-metolachlor/benoxacor.

Application Methods: Postemergence from the spike to 6 leaf stage of glyphosate tolerant corn.

Residual Activity: HALEX GT will provide residual control of American and Eastern black nightshade, lady's-thumb, lamb's-quarters, pigweed spp., mustard (wild), velvetleaf, barnyardgrass, crabgrass (smooth and hairy), fall panicum, foxtails (green, yellow and giant), witchgrass.

HEXAZINONE

Trade Names: PRONONE, VELPAR.

Chemical Family: Triazine.

Crop and/or Non-Crop Registrations: Christmas trees, coniferous reforestation, non-cropland.

Sensitive Weeds: Most herbaceous broadleaf weeds and grasses including raspberry, bluejoint grass, gold-

enrod and brome grass; spot applications control aspen, ash, maple, cherry and birch.

Uptake and Translocation: Absorbed through roots and foliage; translocation is primarily upwards through xylem.

Basis of Selectivity: Tolerant species metabolize hexazinone faster than sensitive species. For conifers, at least part of the selectivity is due to the tree roots being deeper than hexazinone leaches into the soil.

Application Methods: For broadcast applications, apply preemergence or as a postemergence foliar spray during active plant growth. For spot applications, use an exact-delivery hand gun applicator to apply undiluted VELPAR as close as possible to the root collar of plants to be controlled; keep spots at least 1 m away from desirable conifers. Apply PRO-NONE with an approved granular applicator.

Residual Activity: Half-life of 2 months on a Flanagan silt loam in Illinois. Half-life of 2½ months on a silty clay in Northern Ontario.

Unique Characteristics: Rainfall is needed to activate hexazinone in the soil. Do not use on sandy, gravelly or rocky soils, or on frozen ground. Do not apply on steep slopes. Do not apply to areas where the roots of desirable trees may extend. Liquid formulation is flammable. A bioassay may be used to determine soil residue levels when sensitive crops are to be planted in soil treated with hexazinone.

IMAZAPYR

Trade Name: ARSENAL.

Chemical Family: Imidazolinone.

Crop and/or Non-Crop Registrations: Non-crop/non-graze areas such as industrial sites, railroad ballast, spot treatments for rail and highway rights-of-way and pipeline rights-of-way stations including well sites, battery stations and compressor or valve stations.

Sensitive Weeds: Annual and perennial grass and broadleaf weeds such as: annual – black medick, rough cinquefoil, common groundsel, hemp-nettle,

kochia, lamb's-quarters, mustard spp., pigweed spp., pineappleweed, ragweed spp., Russian thistle, stinkweed, annual sow-thistle, wild buckwheat, annual bluegrass, foxtail spp., witch grass; biennial/perennial – bladder campion, bull thistle, burdock, Canada thistle, sulfur cinquefoil, clover spp., dandelion, dog-strangling vine, field bindweed, goat's beard, goldenrod, leafy spurge, milkweed, mouse-eared chickweed, mullein spp., ox-eye daisy, plantain spp., poison-ivy, sheep sorrel, toadflax, tufted vetch, wild carrot, wild grape, wild strawberry, brome grass, Canada bluegrass, fescue spp., quack grass, yellow nut sedge; Seedling woody species – maple, poplar, raspberry and wild rose.

Uptake and Translocation: Absorbed by both roots and foliage of sensitive vegetation. Translocated in both the xylem and phloem.

Basis of Selectivity: None.

Application Methods: Postemergence on actively growing weeds. Control of non-emerged sensitive species will also be provided in the year of application. Apply in 100–550 L of water/ha with high-volume, high-pressure handguns and vehicle-mounted directed-spray equipment or conventional boom-mounted, manifold-mounted or off-centred nozzles. Low-volume, hand-held backpacks, knapsacks or other pump-up-type sprayers may also be used for direct applications to foliage. Addition of non-ionic surfactant at 1 L/400 L of spray solution is recommended for spray volumes greater than 550 L/ha. A foam-reducing agent may be added at the recommended rate, if required.

Residual Activity: Season-long control of sensitive species.

Unique Characteristics: Do not contaminate ponds, lakes, streams, wetlands or sloughs and do not apply within 15 m of a wetland area or body of water. Do not mix or store in unlined steel (except stainless steel) containers or spray tanks. For ground application only. Do not use where roots from desirable vegetation may extend into the treated

area (maintain a distance from desirable trees equal to at least twice the distance from the trunk to the dripline). To be used by licensed applicators only.

IMAZETHAPYR

Trade Name: CONQUEST B (Available only in CONQUEST LQ co-pack), PURSUIT.

Chemical Family: Imidazolinone.

Crop and/or Non-Crop Registrations: Soybeans, a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap)* *Weed Control Ratings*, page 87 for specific crop registrations, clearfield corn, clearfield canola processing peas, snow peas and alfalfa for seed production.

Sensitive Weeds: Soil applications – green foxtail, yellow foxtail, witch grass, barnyard grass, lamb's-quarters, redroot pigweed, smartweed, lady's-thumb, wild mustard, velvetleaf, common ragweed and reduced competition from Eastern black nightshade and proso millet. Postemergence application – green foxtail, yellow foxtail, witch grass, barnyard grass, redroot pigweed, velvetleaf, wild mustard, cocklebur, Eastern black nightshade, ragweed and reduced competition from proso millet, large crab grass, lamb's-quarter's, wild buckwheat and yellow nut sedge. Late postemergence application – green and yellow foxtail (up to 4 leaf stage), barnyard grass (up to 6 leaf stage), redroot pigweed (up to 12 leaf stage) and velvetleaf (up to 8 leaf stage).

Uptake and Translocation: Absorbed by both roots and foliage. Translocation in both xylem and phloem.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Early preplant (up to 30 days before planting), preplant incorporated, preemergence and postemergence up to the 2 leaf stage of weeds.

Residual Activity: Persistence depends on weather and soil conditions (more persistent under dry conditions). Some rotational restrictions apply, refer to Tables 4-4 and 4-5. *Herbicide Crop Rotation and*

Soil pH Restrictions, on page 61, and page 63 for more information.

Unique Characteristics: Can be applied up to 30 days prior to planting. Registered for use in reduced and no-till situations. Tank-mixing is recommended for heavy infestations of ragweed or barnyard grass. Postemergence application requires the addition of AGRAL 90, AGSURF or ENHANCE surfactant and liquid fertilizer solution. Temporary soybean discoloration and/or shortening may occur with postemergence applications. A period of 100 days is required between application and planting winter wheat.

IMAZETHAPYR + BENTAZON

Trade Name: CLEANSWEEP (co-pack of PURSUIT + BASAGRAN FORTÉ).

Chemical Family: Imidazolinone + Benzothiadiazine.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual grass (barnyard grass, green and yellow foxtail) and broadleaf (cocklebur, flower-of-an-hour, lady's-thumb, lamb's-quarters, pigweed, ragweed, shepherd's-purse, stinkweed, velvetleaf, wild mustard, Eastern black nightshade) species including triazine resistant biotypes and reduced competition from yellow nut sedge, Canada thistle and field bindweed.

Uptake and Translocation: Contact and systemic. Absorption occurs through foliage and roots.

Basis of Selectivity: Metabolism by soybeans.

Application Methods: Postemergence.

Unique Characteristics: A liquid ammonium fertilizer solution (such as UAN) must be added at 2 L/ha. Some rotational restrictions apply. See label for details. Refer to notes on IMAZETHAPYR and BENTAZON for additional information on each component.

IMAZETHAPYR + METRIBUZIN

Trade Name: CONQUEST LQ (co-pack of CONQUEST A + CONQUEST B).

Chemical Family: Imidazolinone + s-triazine.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual grass and broadleaf species. See label for specific species controlled.

Application Methods: Early preplant incorporated and preemergence.

Unique Characteristics: Some rotational restrictions apply. See label for details. Refer to notes on imazethapyr and metribuzin for additional information on each component.

IMAZETHAPYR/PENDIMETHALIN

Trade Name: VALOR.

Chemical Family: Imidazolinone/dinitroaniline.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual grass and broadleaf species including triazine-resistant biotypes. See label for specific species controlled.

Application Methods: Preplant incorporated.

Unique Characteristics: Some rotational restrictions apply. See label for details. Refer to notes on imazethapyr and pendimethalin for additional information on each component.

ISOXAFLUTOLE + ATRAZINE

Trade Name: CONVERGE XT (co-pack CONVERGE FLEXX + CONVERGE 480), or tank-mix of CONVERGE FLEXX + atrazine 480.

Chemical Family: Isoxazole + s-triazine.

Crop and/or Non-Crop Registrations: Corn, field.

Sensitive Weeds: Annual grasses and broadleaf weeds including triazine and ALS inhibitor tolerant biotypes: green, yellow and giant foxtail, barnyard grass, witch grass, large and smooth crabgrass, lamb's-quarters, pigweed, common ragweed, Eastern black nightshade, velvetleaf, wild mustard,

wormseed mustard, wild buckwheat, lady's-thumb, seedling dandelion and seedling plantain.

Uptake and Translocation: Absorbed by roots and shoots of germinating weeds.

Basis of Selectivity: Metabolized by tolerant species. Preemergence and early postemergence up to the 3 leaf stage of corn. Provides season long weed control. Winter wheat can be grown 4 months after application, corn, soybeans, spring cereals, alfalfa, spring canola and processing peas can be grown the following year. Weed seedlings that emerge prior to activation of herbicide by rainfall can be controlled if less than 5 cm in height. Not for use on sandy loam or finer textured soils with a minimum of 2% organic matter.

ISOXABEN

Trade Name: GALLERY.

Chemical Family: Benzamide.

Crop and/or Non-Crop Registrations: Bareroot and container conifer seedlings.

Sensitive Weeds: St. John's-wort, pineappleweed, lamb's-quarters, purslane, shepherd's-purse, low cud-weed and purslane speedwell.

Uptake and Translocation: Absorbed by roots and translocated to the shoots of germinating weeds.

Basis of Selectivity: Root selectivity.

Application Methods: Applied prior to weed emergence in conifers, 4 or more weeks after crop germination and emergence. Rainfall or irrigation is needed to activate the herbicide.

Residual Activity: Provides season-long control. Germination of some sensitive crop species may be reduced in the year following treatment.

Unique Characteristics: Gallery is registered for use only by members of the Canadian Forest Nursery Weed Management Association.

LINURON

Trade Name: LOROX L.

Chemical Family: Substituted urea.

Crop and/or Non-Crop Registrations: Corn, soybeans, carrots, celery, dill, parsnips, potatoes, asparagus, wheat, oats, barley, gladioli, fruit trees.

Sensitive Weeds: Annual weeds such as barnyard grass, common chickweed, corn spurry, crab grass, velvetleaf, fall panicum, foxtail, goosefoot, goose grass, groundsel, knotweed, lamb's-quarters, redroot pigweed, purslane, common ragweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, witch grass, wormseed mustard, triazine-resistant weeds; seedlings only of dandelion, plantain and sow-thistle.

Uptake and Translocation: Readily absorbed through roots, less so through foliage; translocation primarily upwards in xylem.

Basis of Selectivity: Differential metabolism often coupled with differential uptake and translocation.

Application Methods: Preemergence, postemergence, directed postemergence, pre plus postemergence.

Residual Activity: Does not pose a problem for subsequent crops since phytotoxic residues from applications at agricultural rates disappear within 4 months.

Unique Characteristics: Do not use on sandy or coarse-textured soils having less than 2% organic matter. If unusually heavy rains follow application, severe injury may occur to corn, soybeans, carrots and potatoes.

MCPA

Trade Names: MCPA ESTER 600, MCPA ESTER 500, MCPA SODIUM 300, MCPA AMINE 500, MCPA AMINE 600, REFINE M (co-pack of MCPA + REFINE SG) TROPHY B.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Cereal crops, turf, non-crop sites.

Sensitive Weeds: Many broadleaf weeds, especially buttercup, hemp-nettle, field horsetail (top growth only), seedling dock.

Uptake and Translocation: Absorbed through leaves or roots. Translocates to, and accumulates at, growing points of shoots and roots.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites leads to greater activity in broadleaf weeds than grasses.

Application Methods: Postemergence.

Residual Activity: Some soil residues can be detected for up to 1 month under moist conditions and 2 months under drier conditions.

Unique Characteristics: MCPA is available in amine ester or sodium salt formulations. It is safer than 2,4-D for use on oats, flax and peas. As with 2,4-D, there is a potential drift hazard to nearby susceptible crops such as grapes, turnips, tobacco and cabbage.

MCPB/MCPA

Trade Name: CLOVITOX PLUS, TOPSIDE, TROPOTOX PLUS.

Chemical Family: Phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Seedling white, ladino, alsike or red clovers direct seeded or underseeded in wheat, oats, barley, rye, pastures, field corn, peas, grapes (not TOPSIDE).

Sensitive Weeds: Small emerged mustards, stinkweed, ragweed, lamb's-quarters, redroot pigweed, shepherd's-purse, volunteer rapeseed, wild radish, hemp-nettle, annual sow-thistle; top-growth control of bull thistle, Canada thistle, curled dock, plantain, perennial sow-thistle, field bindweed, horsetail, buttercup.

Uptake and Translocation: Absorbed through the foliage and readily translocated, especially to the growing points.

Basis of Selectivity: MCPB is not directly toxic to plants. Susceptible weeds convert MCPB to MCPA.

Application Methods: Postemergence. In cereals, clovers and peas, apply as an overall spray. In corn, apply with drop pipes after the corn reaches 45 cm

before the beginning of tasselling. Apply to pastures after grazing or cutting.

MECOPROP-P

Trade Names: COMPITOX, MECOPROP.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Cereals, turf.

Sensitive Weeds: Many broadleaf weeds such as chickweed, cleavers, plantain, clover, corn spurry, stitchwort, black medick, knotweed, shepherd's-purse, buttercup, Canada thistle (top-growth control) and dandelion. For complete control of Canada thistle, dandelion and black medick, a repeat application will likely be required.

Uptake and Translocation: Absorbed readily by foliage and translocated to roots and throughout shoots, especially to growing points.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses.

Application Methods: Postemergence. Apply to cereals between the 3 leaf and early flag leaf stage. In turf, apply when weeds are actively growing.

Residual Activity: Can persist in soil up to 4 weeks, however, grass can normally be seeded within 1–2 weeks after treatment.

Unique Characteristics: Controls 2,4-D-resistant weeds such as chickweed, clovers, black medick and young knotweed. Do not spray on grain underseeded to legumes. If cereals are stressed at the time of application, deformed heads and missing florets may result. Can be safely used on bentgrass, however, injury may occur if temperature is above 27°C. Effectiveness will be reduced if rain occurs within 4–6 hours after treatment.

MECOPROP-P/2,4-D

Trade Names: IPCO PREMIUM 2-WAY XP TURF HERBICIDE, MECOTURF PLUS 2,4-D, TURF-RITE 2+2.

Chemical Family: Phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Turf.

Sensitive Weeds: Many broadleaf weeds such as chickweed, cleavers, plantain, clover, corn spurry, stitchwort, black medick, knotweed, shepherd's-purse, buttercup, Canada thistle (top-growth control) and dandelion.

Uptake and Translocation: Absorbed through leaves and roots, translocates to growing points.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses.

Application Methods: Postemergence. Apply when weeds are actively growing.

MESOTRIONE

Trade Name: CALLISTO.

Chemical Family: Triketone.

Crop and/or Non-Crop Registrations: Corn (field, seed and sweet).

Sensitive Weeds: Annual broadleaf weeds, including triazine and group 2 resistant biotypes.

Uptake and Translocation: Readily absorbed by, shoots, roots, stems and leaves and then translocated to other plant parts.

Basis of Selectivity: Inhibits the HPPD enzyme found in photosynthetic cells of susceptible species. Symptoms on susceptible plants are bleaching followed by necrosis. Tolerant species rapidly metabolize mesotrione.

Application Methods: Preemergence and postemergence up to the 8 leaf stage of field, seed and sweet corn. Postemergence applications require the addition of a non-ionic surfactant.

Residual Activity: Degradation primarily by soil microbial action. Mesotrione will provide residual control of annual broadleaf weeds.

Unique Characteristics: When mesotrione is tank-mixed with atrazine there is a synergistic effect and improved control of broadleaf weed species. Mesotrione can be tank-mixed with either a soil applied or postemergence grass herbicide for "one-pass" weed control. Mesotrione has low volatility and poses a reduced risk to nearby sensitive crops.

METAM SODIUM

Trade Name: VAPAM.

Chemical Family: Thiocarbamate.

Crop and/or Non-Crop Registrations: Field and greenhouse seedbeds. Field-replant sites of fruits, vegetables, tobacco, ornamentals and forest-tree stock.

Sensitive Weeds: Most scarified weed seeds and freshly vegetative parts including rhizomes and germinating seedlings.

Basis of Selectivity: Most plant parts are sensitive. Crops are not planted until all fumigant has dissipated from the soil. With moisture, methyl isothiocyanate gas is released, which kills most scarified seeds and fleshy vegetative parts including rhizomes and germinating seedlings.

Application Methods: Apply uniformly using injectors, water or other incorporation tools to carry the product to the desired soil depth. May be applied via the irrigation system. No gas-proof cover is required unless the soil is very porous, however, a sprinkler application of water should be used to provide a surface "water seal".

Residual Activity: 10–40 days depending on soil temperature and the amount of organic matter present in the soil. Persistence is greatest at low temperatures and high levels of organic matter. Planting may take place 12–16 days after the treatment and following a lettuce-seedling bioassay that indicates no injury.

Unique Characteristics: Also controls nematodes, soil fungi and soil insects. All traces of toxic gases must be dissipated from the treated soil before planting or plant injury may occur.

METOLACHLOR

See S-METOLACHLOR.

METOLACHLOR/ATRAZINE

See S-METOLACHLOR/ATRAZINE.

METRIBUZIN

Trade Names: CONQUEST A (Available only in CONQUEST LQ co-pack), SENCOR 480 F, SENCOR 75 DF

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Established asparagus, faba beans, potatoes, soybeans, transplant tomatoes, apples, apricots, peaches, cherries, corn, with trifluralin or with terbacil or with s-metolachlor/benoxacor on apples, apricots, cherries, plums, peaches and pears.

Sensitive Weeds: Lamb's-quarters, wild mustard, redroot pigweed, common ragweed, shepherd's-purse, lady's-thumb, velvetleaf, jimsonweed, prostrate pigweed, Russian thistle, yellow wood-sorrel, prickly mallow, chickweed, cocklebur, carpetweed, dandelion seedlings, barnyard grass, crab grass, foxtail, fall panicum, witch grass, Johnson grass seedlings and cheat grass.

Uptake and Translocation: Some uptake through the foliage but the major route is via the roots. Translocation upwards in the xylem.

Basis of Selectivity: Degradation by tolerant species.

Application Methods: Preplant incorporated (potatoes, soybeans, apples, apricots, peaches, cherries, corn, tomatoes and triazine-tolerant canola); preemergence (asparagus, potatoes, soybeans and triazine-tolerant canola); postemergence (potatoes, tomatoes, corn and triazine-tolerant canola).

Residual Activity: Varies with the climate. At normal-use rates the half-life is 1–2 months.

Unique Characteristics: Heavy rainfall following application may cause crop damage. Some varieties of potato, soybean and tomato are less tolerant than others. Triazine-resistant weeds are not controlled. Do not use on muck soils.

METRIBUZIN + S-METOLACHLOR

Trade Name: BOUNDARY (co-pack of SENCOR DF SOYBEAN + DUAL MAGNUM SOYBEAN).

Chemical Family: S-triazine+Acetanilide.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual grass and broadleaf species. See label for specific species controlled.

Application Methods: Preplant incorporated and preemergence.

Unique Characteristics: Refer to notes on s-metolachlor and metribuzin for additional information on each component.

NAPROPAMIDE

Trade Names: DEVRINOL 50 DF, DEVRINOL 2G, DEVRINOL 10G.

Chemical Family: Amide.

Crop and/or Non-Crop Registrations: Asparagus, cole crops (cabbage, broccoli, cauliflower, Chinese broccoli, Chinese mustard greens, Chinese Nappa cabbage, Chinese radish), garlic, kohlrabi, peppers, pumpkin, squash, fuzzy squash, rutabagas, tomatoes, tobacco, raspberries, blackberries, cultivated lowbush blueberries, established highbush blueberries, boysenberries, cranberries, loganberries, newly planted or established strawberries, apples, grapes, peaches and pears, newly transplanted or established ornamentals, woody nursery stock, forest tree stock and container-grown ornamentals (see label for species). Apply with simazine or with terbacil on new plantings of apples, apricots, cherries, plums, peaches and pears.

Sensitive Weeds: Many annual weeds including crab grass, barnyard grass, annual bluegrass, foxtails, sandbur, wild oats, goose grass, chickweed, groundsel, redroot pigweed, lamb's-quarters, purslane, prostrate knotweed, pineappleweed and prickly lettuce.

Uptake and Translocation: Absorbed through the roots of germinating weeds. Translocated upward through seedling.

Basis of Selectivity: Metabolized by tolerant species. Root growth of germinating seedlings is inhibited. Established plants are not affected due to placement selectivity.

Application Methods: May be applied preplant incorporated using water as the carrier. Incorporation should be uniform, and to a chemical depth of 2.5–5 cm, using irrigation or proper incorporation equipment (e.g. tandem discs or field cultivator with sweep teeth) followed by a levelling device. On established crops, apply to a weed-free soil surface and irrigate in if no rainfall occurs within 7 days after application in spring or fall, or within 2 days after application in summer; irrigate with sufficient water to wet the soil to a depth of 5–10 cm (approximately 7 mm of rain). For post-plant application in tobacco, apply in 25 cm band over the row. Cross-disc or cross-plough after harvest to dilute soil residue before planting cover crop.

Residual Activity: Provides season-long weed control if properly incorporated. Deep ploughing will minimize any carryover effect.

Unique Characteristics: Will not control germinated weeds. Resists leaching. To avoid injury to crops not registered for use with napropamide, do not plant until 12 months after the last napropamide application.

NICOSULFURON

Trade Name: ACCENT.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Field corn, certain varieties of sweet corn (refer to product label), and seed corn (contact seed source for details on specific inbreds).

Sensitive Weeds: Quack grass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, witch grass. Control of yellow foxtail is only achieved with either the addition of MERGE or the addition of 28% UAN at a rate of 5 L/ha along with the recommended non-ionic surfactant.

Uptake and Translocation: Following foliar absorption, nicosulfuron is rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and regrowth. Tolerant species rapidly convert nicosulfuron to non-phytotoxic metabolites.

Application Method: Postemergent within the 1–8 leaf stage of corn.

Residual Activity: No soil residual activity.

Unique Characteristics: Emerged grasses will be controlled by nicosulfuron but subsequent germinating grasses will not be controlled. A non-ionic surfactant must be added at 0.2% v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Do not apply to corn that has been treated with an organophosphorus soil insecticide.

NICOSULFURON + IFLUFENZOPYR/DICAMBA

Trade Name: ACCENT TOTAL (co-pack of ACCENT + DISTINCT).

Chemical Family: Sulfonylurea + Semicarbazone/ Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Sensitive Weeds: Annual grass and broadleaf species. See label for specific species controlled.

Uptake and Translocation: Refer to notes on nicosulfuron and diflufenzopyr/dicamba for additional information on each component.

Basis of Selectivity: Refer to notes on nicosulfuron and diflufenzopyr/dicamba for additional information on each component.

Application Methods: Postemergent, from the 2–8 leaf stage of corn.

Unique Characteristics: Refer to notes in this section on nicosulfuron and diflufenzopyr/dicamba for additional information on each component.

NICOSULFURON + PROSULFURON/DICAMBA

Trade Name: ACCENT 1-PASS (co-pack of ACCENT + PEAKPLUS).

Chemical Family: Sulfonylurea + Sulfonylurea/Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Sensitive Weeds: Annual grass and broadleaf species. See label for specific species controlled. For improved yellow foxtail control refer to notes under nicosulfuron.

Uptake and Translocation: Refer to notes on nicosulfuron and prosulfuron/dicamba for additional information on each component.

Basis of Selectivity: Refer to notes on nicosulfuron and prosulfuron/dicamba for additional information on each component.

Application Methods: Postemergent, up to the 7 leaf stage of corn.

Unique Characteristics: Refer to notes on nicosulfuron and prosulfuron/dicamba for additional information on each component.

NICOSULFURON/RIMSULFURON

Trade Name: ULTIM.

Chemical Family: Sulfonylurea/Sulfonylurea.

Crop and/or Non-Crop Registrations: Field corn. Not for use on sweet or seed corn.

Sensitive Weeds: Quack grass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, witch grass, redroot pigweed (including triazine-resistant).

Uptake and Translocation: Following foliar application, nicosulfuron/rimsulfuron rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert nicosulfuron/rimsulfuron to non-phytotoxic metabolites.

Application Method: Postemergence, within the 1–6 leaf stage of corn.

Residual Activity: Rapid soil microbial degradation of nicosulfuron. Refer to notes on rimsulfuron for information on its soil residual activity.

Unique Characteristics: Emerged grasses will be controlled by nicosulfuron/rimsulfuron, but subsequent germinating grass weeds will not be controlled. A non-ionic surfactant must be added at 0.2% v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Do not use on corn hybrids with a crop heat unit (CHU) rating of 2,500 or less, or in geographic regions with 2,500 or less average seasonal CHU.

NICOSULFURON/RIMSULFURON + DIFLUFENZOPYR/DICAMBA

Trade Name: ULTIM TOTAL (co-pack of ULTIM + DISTINCT).

Chemical Family: Sulfonylurea + Semicarbazone/ Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Sensitive Weeds: Annual grass and broadleaf species. See nicosulfuron/rimsulfuron, diflufenzopyr/dicamba and label for specific species controlled.

Uptake and Translocation: Refer to notes on nicosulfuron/rimsulfuron and diflufenzopyr/dicamba for additional information on each component.

Basis of Selectivity: Refer to notes on nicosulfuron and diflufenzopyr/dicamba for additional information on each component.

Application Methods: Postemergence, up to the 6 leaf stage of corn.

Residual Activity: Rapid soil microbial degradation of nicosulfuron. Refer to notes on rimsulfuron for information on its soil residual activity. Half-life of diflufenzopyr/dicamba in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at registered rates.

Unique Characteristics: Refer to notes on nicosulfuron/rimsulfuron and diflufenzopyr/dicamba for additional information on each component.

OXADIAZON

Trade Name: RONSTAR 2G.

Chemical Family: Oxadiazole.

Crop and/or Non-Crop Registrations: Woody ornamental shrubs, vines and trees grown in containers.

Sensitive Weeds: Annual weeds including stinkweed, bittercress, common groundsel, lamb's-quarters, purslane, black nightshade, pigweeds, redroot, tumble, shepherd's-purse, annual bluegrass, barn-yard grass, green and yellow foxtails and crab grass.

Uptake and Translocation: Primarily taken up through emerging shoots when they penetrate through the treated soil layer.

Basis of Selectivity: Greater physiological tolerance relative to susceptible species and lack of contact with sensitive crop tissue.

Application Method: Applications may be made to both newly transplanted and established ornamentals preemergent to weed germination. Existing weed growth must be removed for satisfactory weed control.

Residual Activity: 60–120 days.

Unique Characteristics: When applied to soil, the material is rapidly and strongly fixed by soil colloids. Due to its low water solubility and to this adsorption, the downward and lateral movement is limited under the influence of rain or irrigation. Therefore, the chemical must be applied uniformly for satisfactory weed control. Moisture is required to activate

the chemical. Rainfall or overhead irrigation after application will improve weed control.

OXYFLUORFEN

Trade Name: GOAL.

Chemical Family: Diphenyl ether.

Crop and/or Non-Crop Registrations: Onions, strawberries.

Sensitive Weeds: Purslane, pigweed, annual nightshades, wild buckwheat, lamb's-quarters, field violet, wood-sorrels.

Uptake and Translocation: Primarily foliar absorption but some root absorption. Very little movement within the plant following foliar or root absorption.

Application Methods: Postemergence. Best control is obtained when weeds are in the 2–4 leaf stage and actively growing. The first application can be made when onions have 2 fully developed true leaves. Repeat applications may be necessary to control late-germinating weeds. Apply as a single pre-mulching spray to dormant strawberry plants. Use at least 500 L of water/ha.

Residual Activity: Limited preemergence activity.

Unique Characteristics: Use on dry bulb onions. Do not use when crop or weeds are under stress. Do not apply within 56 days prior to harvest for onions, or within 150 days prior to harvest for strawberries.

PARAQUAT

Trade Name: GRAMOXONE.

Chemical Family: Bipyridylum.

Crop and/or Non-Crop Registrations: Apples, apricots, cherries, currants, gooseberries, grapes, highbush blueberries, peaches, pears and plums established more than 1 year; blackberries, loganberries and red raspberries; inter-row spraying in strawberries; stale seedbed technique for vegetables and field crops; inter-row directed chemical weeding for vegetable fields and established nursery crops; asparagus;

potatoes; established alfalfa and bird's-foot trefoil; pasture renovation; zero tillage corn; conifer control.

Sensitive Weeds: Non-selective – affects all green plants.

Uptake and Translocation: Absorbed by foliage and green bark; little or no translocation.

Basis of Selectivity: All green plant tissue is sensitive. Less effective on plants with a very waxy cuticle and linear leaf shape such as nut sedge. Safe on mature (non-green) bark of woody plants.

Application Methods: Postemergence. Broadcast, or directed spray to avoid contacting leaves or bark of desirable plants. Apply when weeds are less than 15 cm high. Better results are usually obtained if application is made on a dull or cloudy day, or in the evening.

Residual Activity: Essentially no residual activity in soil. Will persist in organic material such as mulches or turf thatch; therefore, do not reseed these areas for 5 days. More than one application per season may be necessary, especially for perennial weeds.

Unique Characteristics: Inactivated by adsorption to soil particles. Not available to homeowners.

PENDIMETHALIN

Trade Name: PROWL 400.

Chemical Family: Dinitroaniline.

Crop and/or Non-crop Registrations: Onions and field corn.

Sensitive Weeds: Green foxtail, yellow foxtail, crab grass, barnyard grass, fall panicum, common chickweed, lamb's-quarters and pigweed.

Uptake and Translocation: Weeds are controlled as they germinate. Translocation is not significant and emerged weeds are not controlled.

Basis of Selectivity: No significant uptake or translocation by the crop.

Application Methods: Onions: postemergence to the crop at loop and 2 leaf stage. Field corn: preemergence and early postemergence. For preemergence

application, pendimethalin may be applied in water or liquid fertilizer. Conduct a fertilizer compatibility test using pendimethalin and any of its registered tank-mix partners. Early postemergence application may only use water as a carrier.

Residual Activity: Persistence depends on weather conditions (more persistent under dry conditions). Only registered crops may be planted in the year of application. Soybeans and corn may be planted the year following application in corn. Days to harvest restriction: 100 days.

Unique Characteristics: Strongly adsorbed to soil particles. Most effective when rain is received within 7 days of application. For onions, apply at both growth stages for season-long control. Tank-mixes in corn or sequential application of other herbicides in onions and corn are required for broad-spectrum weed control. Registered for dry bulb onions grown on muck and mineral soils. Do not graze treated fields or feed treated foliage to livestock prior to 100 days after PROWL application.

PICLORAM/2,4-D

Trade Name: TORDON 101.

Chemical Family: Pyridine/phenoxy.

Crop and/or Non-Crop Registrations: Weed and brush (including conifer) control in non-crop locations, industrial sites and rights-of-way.

Sensitive Weeds: Most broadleaf herbaceous weeds including Canada thistle, sweet and red clover, wild carrot, common ragweed, dandelion, goldenrod, dock, plantain, prickly lettuce, burdock, fleabane and vetch; deciduous and coniferous woody plants except white ash.

Uptake and Translocation: Rapidly absorbed by the roots, stems and foliage. Translocation can be up or down but, like 2,4-D, accumulation is in young, rapidly growing meristematic tissue.

Basis of Selectivity: Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species.

Application Methods: For deciduous and coniferous brush, apply either broadcast using a fixed nozzle (constant volume per hectare) or selectively using a spray gun (variable volume per hectare). As spray gun applications use a more dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed in spring or early summer. To ensure thorough coverage and minimize drift, brush to be treated should be less than 2.5 m tall. For cut-surface treatment, mix with water or ethylene glycol (to reduce the freezing point, if necessary) and apply to cover the cambium layer of freshly cut stumps. For broadleaf herbaceous weeds, apply broadcast in spring or early summer after growth begins.

Residual Activity: Soil residue carryover into the year following application is minimal when applied at recommended rates. Degradation is most rapid under warm, humid conditions. Because small residues of picloram in soil can be phytotoxic to crops such as soybeans, tobacco, tomatoes, potatoes, grapes and many desirable ornamental plants, picloram may not be applied to land used, or land that may be used, for the production of agricultural and horticultural crops.

Unique Characteristics: A permit from the Ministry of the Environment is required to purchase and use picloram/2,4-D in Ontario. Picloram/2,4-D must not be applied over, or near, areas where roots of desirable trees or other plants may extend. Because spray drift is phytotoxic to sensitive plants, an approved drift-control system or additive is recommended when making low-volume applications adjacent to desirable trees or crops.

PROMETRYNE

Trade Name: GESAGARD.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Carrots, peas, leeks, and transplanted celery.

Sensitive Weeds: Lamb's-quarters, lady's-thumb, corn spurry, pigweed, wild mustard, purslane, Eastern black nightshade, chickweed, hemp-nettle and green foxtail.

Uptake and Translocation: Absorbed through foliage and roots. Translocated upwards through xylem, accumulating in the apical meristems.

Basis of Selectivity: Metabolized by tolerant plants and to a lesser extent by sensitive plants, although this is not thought to be the major selective mechanism.

Application Methods: Preemergence or early postemergence (before weeds are 5 cm high). Apply before carrots or peas emerge. Apply 7–14 days after celery is transplanted.

Residual Activity: About 6–8 weeks. A fall cover crop of rye or oats may be sown on the treated land in the same season.

PROPYZAMIDE

Trade Name: KERB.

Chemical Family: Amide.

Crop and/or Non-Crop Registrations: Alfalfa, bird's-foot trefoil, woody nursery stock, lettuce, apples, pears, lowbush blueberries.

Sensitive Weeds: Perennial grasses including quack grass, annual grasses, volunteer cereals and common chickweed.

Uptake and Translocation: Taken up by plant roots and translocated to the foliage. Little foliar absorption.

Basis of Selectivity: Faster degradation in tolerant species.

Application Methods: Preemergence to annual weeds. Postemergence control of perennial grasses when applied in the fall. Apply in the fall from late September to early November when the soil temperature is low but above freezing, and soil moisture is high.

Residual Activity: Persistence is variable (2–9 months), depending on soil type and climatic conditions. Decomposition of the herbicide is slow at temperatures below 15°C but accelerates at temperatures

above this level. Persistence is greatest in sandy soils with low organic matter.

Unique Characteristics: Rainfall or irrigation is required after application to move the herbicide into the root zone for uptake by perennial grasses and germinating annual grasses.

PROSULFURON/DICAMBA

Trade Name: PEAKPLUS (co-pack of PEAK + BANVEL II).

Chemical Family: Sulfonfyl urea+benzoic acid.

Crop and/or Non-Crop Registrations: Field corn.

Sensitive Weeds: Lamb's-quarters (including triazine tolerant), redroot pigweed, cocklebur, lady's-thumb, wild mustard, velvetleaf, common ragweed.

Uptake and Translocation: Following foliar application and uptake, prosulfuron is translocated through phloem to meristematic tissues. Growth of susceptible species ceases rapidly, followed by discolouration of leaves; death takes 1–3 weeks to occur.

Basis of Selectivity: Inhibition of the enzyme acetolactate synthase. Tolerant species rapidly metabolize prosulfuron.

Application Methods: Postemergent, within the 2–7 leaf stages of corn.

Residual Activity: Degradation primarily by soil microbial action. Prosulfuron will provide a sufficient degree of control of later germinating broadleaf weeds. Approved rotational crops are soybeans, dry beans, peas, cereals, and corn. See the label and refer to Tables 4-4 and 4-5. *Herbicide Crop Rotation and Soil pH Restrictions*, on page 61, and page 63 for rotational restrictions.

Unique Characteristics: Prosulfuron must be applied in a tank-mix combination with a reduced rate of dicamba. Refer to the corn recommendation section for products and rates. An adjuvant must be added at 0.2% v/v. Do not apply to corn treated with a granular organophosphate insecticide.

PYRASULFOTOLE/BROMOXNYL

Trade Name: Infinity

Chemical Family: Benzoylpyrazole and Hydroxybenzonitrile.

Crop and/or Non-Crop Registrations: Wheat (spring, durum winter), barley, triticale and timothy (seed production only).

Sensitive Weeds: Annual broadleaf weeds including ALS (Group 2) resistant biotypes: annual sow thistle, chickweed, cleavers, flaxweed, hemp-nettle, kochia, lamb's-quarters, pale smartweed, redroot pigweed, Russian thistle, shepherd's purse, stinkweed, volunteer canola (conventional and herbicide tolerant), wild buckwheat and wild mustard. Suppression of perennial weeds including: Canada thistle, dandelion, perennial sow-thistle.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence – Apply to emerged, young, actively growing weeds. Under cool and/or dry conditions activity may be reduced or delayed. Weed control may also be reduced if application is made when weeds are dust covered or in the presence of heavy dew, fog, or mist/rain. Apply in a minimum of 46.8 L of water/ha at a pressure of 275 kPa. Crops may be treated from the 1 leaf stage of growth until the flag leaf is just visible but still rolled.

Residual Activity: Essentially none.

Unique Characteristics: Application beyond emergence of the flag leaf may result in crop injury. Do not apply to a crop that is stressed by severe weather conditions, frost, low fertility, drought, water-saturated soil, disease or insect damage, as crop injury may result. Do not apply to crops under-sown with legume species. Do not store below -20°C.

PYRAZON

Trade Name: PYRAMIN FL.

Chemical Family: Pyridazinone.

Crop and/or Non-Crop Registrations: Sugar beets and table beets. With NORTRON on sugar beets.

Sensitive Weeds: Annual nightshades, chickweed, knotweed, lady's-thumb, lamb's-quarters, oak-leaved goosefoot, prostrate pigweed, purslane, ragweed, redroot pigweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, wild carrot (seedling), wild mustard, wormseed mustard and yellow rocket (seedling).

Uptake and Translocation: Can be taken up by both roots and leaves, but translocation is upward to leaves where it inhibits photosynthesis.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Preplant incorporated, preemergence, or postemergence after the second true leaf stage of the beets.

Residual Activity: Average persistence is about 4–8 weeks in soil, depending on soil moisture and temperature. Residue carryover problems are unlikely.

Unique Characteristics: With preemergence applications, at least 1.25 cm of rainfall is required for good weed control. Combinations of pyrazon and TCA are most useful where both annual broadleaf weeds and grasses are a problem. These treatments may not be effective on high organic soils or dry soils (i.e. muck soils or with late planted beets when soils are drier). Under these circumstances, postemergence applications of pyrazon plus TCA as a band over the row may be most effective. However, to be selective and effective the chemicals must be applied after the cotyledons of the beets are 2.5 cm long and before the weeds have reached the 4 true leaf stage (10 cm). Where TCA has been used, do not feed beet tops to livestock. TCA residues in the soil can be a problem for some crops such as corn.

QUIZALOFOP-P-ETHYL

Trade Name: ASSURE II.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: Canola, flax, a number of different edible bean market classes,

refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations, peas, rutabagus, industrial fibre hemp, seed alfalfa, soybeans and sugar beets.

Sensitive Weeds: Green foxtail, barnyard grass, fall panicum, witch grass, proso millet, wild oats, volunteer cereals and volunteer corn.

Uptake And Translocation: Rapidly absorbed and readily translocated in both the xylem and phloem from the treated foliage to the root system and growing points of the plant.

Basis of Selectivity: Disruption of fatty acid biosynthesis leading to increased permeability and cellular disruption in sensitive plants. Rapid metabolism of the active herbicide in tolerant species.

Application Methods: Postemergence.

Residual Activity: Rapid microbial degradation and essentially no soil activity.

Unique Characteristics: Apply with SURE-MIX at 5 L/1,000 L of spray solution.

RIMSULFURON

Trade Name: ELIM EP (available only in BATTALION and GALAXY co-packs), PRISM.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: ELIM EP – Field corn. Not for use on sweet or seed corn. PRISM – Potatoes, transplanted processing tomatoes. Not for use on potatoes grown for seed.

Sensitive Weeds: Green foxtail, fall panicum, barnyard grass, redroot pigweed (including triazine-resistant), hairy nightshade, suppression of yellow foxtail, witch grass, lamb's-quarters.

Uptake and Translocation: Following foliar application, rimsulfuron is rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert rimsulfuron to non-phytotoxic metabolites.

Application Method: Postemergent, within the spike 3 leaf stage of corn. Prior to initiation of flowering in potatoes.

Residual Activity: Provides season long control of labeled weeds to canopy closure.

Unique Characteristics: See nicosulfuron/rimsulfuron.

RIMSULFURON + GLYPHOSATE

Trade Name: GALAXY (co-pack of ELIM EP + ROUNDUP WEATHERMAX).

Chemical Family: Sulfonylurea + Amino acid.

Crop and/or Non-Crop Registrations: Glyphosate tolerant (Roundup Ready) corn only.

Sensitive Weeds: Annual grass and broadleaf species. See label for specific species controlled.

Uptake and Translocation: Refer to notes on rimsulfuron and glyphosate for additional information on each component.

Basis of Selectivity: Refer to notes on rimsulfuron and glyphosate for additional information on each component.

Application Methods: Postemergence, up to the 6 leaf stage of corn.

Unique Characteristics: Refer to notes on rimsulfuron and glyphosate for additional information on each component.

RIMSULFURON + S-METOLACHLOR + DICAMBA

Trade Name: BATTALION (co-pack of ELIM EP + DUAL II MAGNUM + BANVEL II).

Chemical Family: Sulfonylurea + Acetanilide + Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Sensitive Weeds: Annual grass and broadleaf species, suppression of quackgrass. See label for specific species controlled.

Uptake and Translocation: Refer to notes on rimsulfuron, s-metolachlor and dicamba for additional information on each component.

Basis of Selectivity: Refer to notes on rimsulfuron, s-metolachlor and dicamba for additional information on each component.

Application Methods: Preemergence and postemergence up to the 3 leaf stage of corn.

Residual Activity and Unique Characteristics: Refer to notes on rimsulfuron, s-metolachlor and dicamba for additional information on each component.

S-METOLACHLOR

Trade Names: DUAL MAGNUM, DUAL II MAGNUM.

Chemical Family: Acetanilide.

Crop and/or Non-Crop Registrations: Corn, soybeans, a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations, transplanted cole crops (cabbage, cauliflower, broccoli), transplanted tomatoes, potatoes, sugar beets, processing peas, rutabagas and sweet white lupins, apples, apricots, cherries, peaches, pears and plums.

Sensitive Weeds: Large and smooth crab grass; witch grass; barnyard grass; fall panicum; giant, green and yellow foxtail; yellow nut sedge; American nightshade, Eastern black nightshade and tall waterhemp.

Uptake and Translocation: Absorbed by germinating grasses mainly through the shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoots.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Early preplant, preplant incorporated and preemergence. Early postemergence on corn (spike to 2 leaf stage of corn). Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6–10 km/hr or a vibrating shank cultivator at 10–13 km/hr; one incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application.

Residual Activity: Activity will normally be maintained for 10–14 weeks.

Unique Characteristics: The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nut sedge control requires a preplant incorporated application. Winter cereals may be planted 4–5 months after metolachlor application. Many tank-mix combinations are registered on various crops. Do not use on muck soils or coarse-textured soils low in organic matter. DUAL II MAGNUM contains benoxacor, a chemical that enhances the corn plant's ability to metabolize s-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

S-METOLACHLOR/ATRAZINE

Trade Name: PRIMEXTRA II MAGNUM.

Chemical Family: Acetanilide/s-triazine.

Crop and/or Non-Crop Registrations: Corn (ensilage, field, seed and sweet).

Sensitive Weeds: Germinating annual broadleaf weeds and annual grasses such as American nightshade, Eastern black nightshade, lady's-thumb, lamb's-quarters, wild mustard, purslane, prostrate pigweed, redroot pigweed, wild buckwheat, smartweed, ragweed, crab grass, barnyard grass, green foxtail, yellow foxtail, giant foxtail, witch grass and fall panicum. Yellow nut sedge can be controlled with a preplant incorporated application.

Uptake and Translocation: Absorbed by germinating grasses mainly through shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoot.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Early preplant, preplant incorporated, and preemergence. Early postemergence on corn (spike to 2 leaf stage of corn). Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6–10 km/hr or a vibrating shank cultivator at 10–13 km/hr. One incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application.

S-metolachlor/atrazine may be applied in nitrogen solutions or liquid fertilizers for preplant incorporated or preemergence weed control. Dry bulk granular fertilizers may be impregnated with metolachlor/atrazine for preplant incorporation.

Residual Activity: Activity will normally be maintained for 10–14 weeks; late-germinating fall panicum will not be controlled. Soybeans, white beans, oats or barley may be planted the following spring.

Unique Characteristics: The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nut sedge control requires a preplant incorporated application. Will not control triazine-resistant weed species. Contains atrazine in low amounts, which may carry over in a dry year. Is effective over a wide range of soil types and has a good margin of crop safety. Perennial weeds are not controlled. PRIMEXTRA II MAGNUM contains benoxacor, a chemical that enhances the corn plant's ability to metabolize s-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

SCLEROTINIA MINOR (STRAIN IMI 344141)

Trade Names: SARRITOR GRANULAR BIOLOGICAL HERBICIDE.

Crop and/or Non-Crop Registrations: Turfgrass.

Sensitive Weeds: Dandelion.

Uptake and Translocation: The active ingredient, Sclerotinia minor is a naturally occurring fungus that when applied to dandelion will grow into the weed and absorb plant tissue until the weed is controlled.

Application Methods: Postemergence. Apply when daytime high temperatures are 18–24°C and when rainfall occurs within 12 hours of application.

Residual Activity: Essentially none, will not control un-emerged dandelion.

Unique Characteristics: SARRITOR will usually take between 5–7 days to suppress/control dandelion. This product will not affect grass species, but severe

damage to non-target desirable broadleaf plant species may occur if SARRITOR comes in contact.

SETHOXYDIM

Trade Name: POAST ULTRA.

Chemical Family: Cyclohexanedione.

Crop and/or Non-Crop Registrations: Canola (rapeseed), flax, soybeans, a number of different edible bean market classes, refer to Table 7-1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 87 for specific crop registrations peas, onions, tomatoes, potatoes, sweet potato, pumpkin, squash, cucumbers, alfalfa, buckwheat, creeping red fescue, garlic, broccoli, cabbage, cauliflower, peppermint, spearmint, snow peas, apples, apricots, cherries, peaches, pears, plums, highbush blueberries, cranberries, strawberries and sethoxydim-resistant corn.

Sensitive Weeds: Annual grasses (wild oats, foxtails, barnyard grass, large crab grass, proso millet, fall panicum and witch grass, volunteer corn and cereals and quack grass.

Uptake and Translocation: Absorbed by foliage. Translocated upwards and downwards in plant.

Basis of Selectivity: Degraded by tolerant species (broadleaf plants).

Application Methods: Postemergence to actively growing annual grasses in the 1–6 leaf stage and quack grass in the 1–3 leaf stage. Use flat fan nozzles and add MERGE adjuvant to the spray mix. Alternatively, ASSIST OIL CONCENTRATE or Ammonium sulphate plus ASSIST OIL CONCENTRATE may be used. Other postemergence herbicides not recommended as tank-mix combinations on the label must be applied at least 4 days before or after sethoxydim application. Aerial application is also registered.

Residual Activity: Essentially none. A second application and/or cultivation may be necessary to control grasses that emerge after treatment.

Unique Characteristics: Susceptible grasses, when sprayed, stop growing immediately and then

gradually turn yellow to purple to brown over a period of 7–21 days, depending on growing conditions and crop competition. Rainfall within 1 hour after application may reduce effectiveness. If treated grasses are stressed (drought, flooding, prolonged cool temperatures) control will be delayed or reduced.

SIMAZINE

Trade Names: PRINCEP NINE-T, SIMADAX, SIMAZINE 480.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Corn, established asparagus, bird's-foot trefoil, raspberries, loganberries, blackberries, highbush blueberries, alfalfa, apples, apricots, cherries, peaches, pears and plums established for 1 year or more; grapes established for 3 or more years; shelterbelts established for at least one growing season (caragana, green ash, Siberian elm, American elm and Manitoba maple); new or established Christmas tree and woodland plantations (2 years or older white pine and balsam fir); woody ornamentals and nursery stock established for at least 1 year (cedar, barberry, apple, flowering crab apple, box wood, cotoneaster, dogwood, holly, rose, yews, chamaecyparis, hemlock, juniper, multiflora rose, peony; spruce, mugho pine, black walnut and white ash); nursery container stock (cedar, juniper, yew); aquatic weed control; non-cropland. Conifer site preparation before planting of fir, pine and spruce (PRINCEP NINE-T only).

Sensitive Weeds: Annual broadleaf weeds such as pigweed, lady's-thumb, lamb's-quarters, purslane, ragweed, volunteer clover, wild buckwheat, smartweed, plantain and groundsel; annual grasses such as barnyard grass, crab grass, wild oats and yellow foxtail (triazine-resistant biotypes of foxtail, lamb's-quarters, pigweed and groundsel will not be controlled); most perennial species starting freshly from seed.

Uptake and Translocation: Absorbed by roots; little or no foliar absorption; translocated upwards in xylem, accumulating in apical meristem and leaves with napropamide on new plantings of apples, apricot, cherries, plums, peaches and pears.

Basis of Selectivity: Some species, such as corn, metabolize simazine. In most crops, selectivity is based on the roots of the crop plants being deeper than the depth to which simazine leaches.

Application Methods: Preplant incorporated (to a depth of 2.5 cm) or preemergence in corn; preemergence in other crops. Broadcast or band application. In fruit crops, apply a 1 m wide band under the plants; cultivate or sod the area between the rows. For aquatic weed control, apply as a draw-down treatment or water-volume application in drainage ditches and ponds with no water flow-through.

Residual Activity: Soil residues may persist for more than 1 season. After spraying with simazine, do not plant any crop in the treated area in the same year except corn. Where rates in excess of 2 kg/ha have been applied, do not plant rotational crops in the following year; soils should be tested if there is any question of excessive residues remaining.

Unique Characteristics: Needs sufficient moisture to be activated. Should be applied only once per season. To avoid build-up of resistant weeds, simazine should be rotated with other non-triazine residual herbicides. Simazine is more persistent than atrazine. Where rainfall is sufficient to cause erosion, soil containing simazine may wash to lower areas of land and injure existing or subsequent crops.

SURFACTANT

See Chapter 5. *Notes on Adjuvants*, page 69.

TERBACIL

Trade Name: SINBAR.

Chemical Family: Uracil.

Crop and/or Non-Crop Registrations: Apples, apricots, cherries, highbush blueberries, peaches, pears, plums, spearmint, peppermint, and strawberries; with napropamide on new plantings of apples, apricots, cherries, plums, peaches and pears.

Sensitive Weeds: Barnyard grass, bluegrass, crab grass, foxtail, chickweed, cheat grass, perennial rye grass, wild barley, mustard, prickly lettuce, stinkweed, annual sow-thistle, henbit, lamb's-quarters, pigweed, purslane and ragweed. Partial control of quack grass, horsenettle, vetch and yellow nut sedge.

Uptake and Translocation: Uptake is mostly through roots, although partially through foliage and stem. Translocation is upward into leaves.

Basis of Selectivity: Used only on established plantings so that roots of crop are below depth to which chemical penetrates. May also be slower translocation and faster degradation in tolerant species.

Application Methods: Apply to the soil surface in 200–1,000 L water/ha. If weed growth is present in apples, paraquat may be mixed with spray. Rates for strawberries are considerably lower and can be applied in spring, postharvest or late fall. Control of perennial grasses may be improved by cultivation prior to treatment.

Residual Activity: May be up to 2 years. Residues are likely to be higher on heavier soil types if higher rates and repeated applications are used.

Unique Characteristics: Moisture is necessary to activate the chemical within 2 weeks after application. Do not apply on soils with less than 1% organic matter, nor on eroded soil areas. Use lower rates on soils with 1%–2% organic matter. Do not apply on weak or diseased strawberry plants.

THIFENSULFURON-METHYL

Trade Name: PINNACLE.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Soybeans, tomatoes.

Sensitive Weeds: Redroot pigweed, lamb's-quarters, velvetleaf, lady's-thumb and wild mustard.

Uptake and Translocation: Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds.

Basis of Selectivity: Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants that leads to a rapid cessation of cell division and plant growth. Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites.

Application Method: Postemergence.

Residual Activity: Rapid soil microbial degradation. Half-life of 5 days at 25°C soil temperatures.

Unique Characteristics: Labelled species can be controlled up to 10 cm in height. Redroot pigweed is very sensitive. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on the growing conditions. Velvetleaf control is greatly enhanced by the inclusion of ammonium containing fertilizer (such as a UAN solution).

THIFENSULFURON-METHYL/ TRIBENURON-METHYL

Trade Name: REFINE SG, REFINE M (co-pack of REFINE SG + MCPA)

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Wheat (spring, winter, durum), barley, oats not underseeded to legumes or grasses. REFINE SG can be applied to winter wheat in the fall or the spring.

Sensitive Weeds: Lamb's-quarters, annual smartweed (green smartweed, lady's-thumb), chickweed, hemp-nettle, wild buckwheat, cow cockle, stinkweed, Canada thistle, sow-thistle, round-leaved mallow.

Uptake and Translocation: Following foliar application, is rapidly absorbed and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell

division and growth. Tolerant species rapidly convert to non-phytotoxic metabolites.

Application Method: Postemergence.

Residual Activity: Rapid soil microbial degradation.

Unique Characteristics: A non-ionic surfactant must be added. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on growing conditions. Tank-mixes with MCPA and 2,4-D for control of ragweed and mustards.

TOPRAMEZONE

Trade Name: IMPACT.

Chemical Family: Pyrazolone.

Crop and/or Non-Crop Registrations: Corn (field, seed and sweet).

Sensitive Weeds: Annual broadleaf and grassy weeds, including triazine and group 2 resistant biotypes.

Basis of Selectivity: Inhibits the HPPD enzyme found in photosynthetic cells of susceptible species. Symptoms on susceptible plants are bleaching followed by necrosis. Tolerant species rapidly metabolize topramezone.

Application Methods: Postemergence in field corn between the 1–8 leaf stage for broadleaf weeds and 1–4 leaf stage of grassy weeds.

Residual Activity: Degradation primarily by soil microbial action. Topramezone provides soil residual activity against broadleaf weeds.

Unique Characteristics: The activity of topramezone is significantly enhanced by atrazine. A tank mix of Topramezone with atrazine and dimethenamid-P provides a "one-pass," postemergence weed control program with residual activity against grass and broadleaf weeds.

TRALKOXYDIM

Trade Name: ACHIEVE LIQUID.

Chemical Family: Cyclohexanedione.

Crop and/or Non-Crop Registrations: Spring wheat, spring barley, crested wheatgrass, creeping red fescue, meadow and smooth brome grass, northern wheatgrass, slender wheatgrass and western wheatgrass.

Sensitive Weeds: Wild oats.

Uptake and Translocation: Uptake through the leaves, translocated to growing points of roots, shoots and leaves.

Basis of Selectivity: Metabolized in tolerant species.

Application Methods: Postemergence to actively growing wild oats at 1–5 leaf stage. Rainfast in 1 hour.

Residual Activity: None.

Unique Characteristics: Safe on all varieties of spring wheat and barley. May be applied to cereal crops underseeded to legumes such as clover, alfalfa, sainfoil or bird's-foot trefoil. Do not feed or graze forage in year of treatment.

TRICLOPYR

Trade Name: GARLON 4, RELEASE.

Chemical Family: Pyridine.

Non-Crop Registrations: GARLON 4 – Site preparation for lowbush blueberry, and the control of unwanted woody plants and annual and perennial broadleaf weeds in non-crop areas including rights-of-way, electrical power lines, communication lines, pipelines, roadsides and manufacturing and storage sites. RELEASE silvicultural herbicide is recommended for the control of undesirable woody plants and annual and perennial broadleaf weeds in woodland management.

Sensitive Weeds: Woody plant species controlled are: alder, ash, aspen, basswood, beech, birch, blackberry, raspberry, buckthorn, cottonwood, dogwood, elderberry, hawthorn, hickory, hop-hornbeam, locust, maples, mulberry, poison-oak, poplar, sumac, willow, honey locust, choke cherry, elm, red maple, oaks and pines. Annual and broadleaf weeds controlled are: burdock, chicory, curled dock, dandelion, field bindweed, lamb's-quarters,

ragweed, smartweed, smooth bedstraw, vetch and wild lettuce.

Uptake and Translocation: Triclopyr is absorbed by both plant leaves and roots. It is readily translocated through plants. It tends to accumulate in meristematic tissues and is not readily metabolized in susceptible plants.

Basis of Selectivity: Tolerant species such as grasses rapidly metabolize triclopyr.

Application Methods: For deciduous and certain conifer species use as a foliage spray when brush species are actively growing. Apply either broadcast using a fixed nozzle (constant volume per ha) or selectively using a spray gun (variable volume per ha). As spray gun applications use a dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed and actively growing. For conifer release in woodland sites, apply in late summer after conifers have hardened off and deciduous trees are in full leaf but prior to autumn coloration. Woody plants may also be controlled by using basal bark, dormant stem and cut-surface treatments.

Residual Activity: Half-life in soil is approximately 30 days under conditions that are favourable for microbial decomposition.

Unique Characteristics: Apply only when there is little or no hazard from spray drift. Small quantities of spray drift may injure susceptible broadleaf plants.

TRIFLURALIN

Trade Names: BONANZA 400, RIVAL, TREFLAN EC.

Chemical Family: Dinitroaniline.

Crop and/or Non-Crop Registrations: Soybeans, black, kidney, lima, nap and white beans, faba beans,

snap beans, lima beans, black beans, canola (rape-seed), sunflowers, turnips, peas (field and canning), direct-seeded alfalfa; transplants of tomatoes, peppers, Brussels sprouts, broccoli, cabbage and cauliflower; carrots, crambe, direct-seeded cabbage and cauliflower, annual flowers, woody ornamental plantings and field-grown nursery stock, perennials, established shelterbelts, strawberries.

Sensitive Weeds: Most annual grasses, pigweed and lamb's-quarters, including the triazine-tolerant biotypes.

Uptake and Translocation: No significant absorption or translocation of trifluralin in crops grown in soil treated with trifluralin. Susceptible weeds are controlled as they germinate. Established weeds are not controlled.

Basis of Selectivity: Physiological growth processes associated with seed germination.

Application Methods: Preplant incorporated. Apply in 100–300 L of water/ha. Use lower rate of the chemical on sandy soils and increased rate for loam-to-clay soils. Do not use on highly organic soils (muck, peat or black sands above 15% organic matter). Incorporate twice in cross directions using a tandem disc (7–10 km/hr) or tine cultivator (10–13 km/hr) set to work 8–10 cm deep. The first incorporation should be done as soon as possible after application, but may be delayed 8–24 hours, depending on label directions. The second incorporation is recommended anytime before planting. Activated upon incorporation; rainfall is not required.

Residual Activity: Recommended application rates provide season-long weed control. Succeeding crops, even fall-seeded grain crops planted in soil that received trifluralin the preceding spring, will not be injured under normal conditions.

Unique Characteristics: Strongly adsorbed to soil particles and shows negligible leaching. Organic matter and clay content influence application rate. Does not control ragweed, annual nightshades or mustards; lady's-thumb may escape.

TRIFLUSULFURON-METHYL

Trade Name: UPBEET.

Chemical Family: Sulfonyleurea.

Crop and/or Non Crop Registrations: Sugar beets. With BETAMIX on sugar beets.

Sensitive Weeds: Redroot and green pigweed, velvetleaf.

Uptake And Translocation: Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds.

Basis of Selectivity: Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants that leads to a rapid cessation of cell division and plant growth. Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites.

Application Methods: Postemergence.

Residual Activity: None.

Unique Characteristics: Must be applied with an approved adjuvant system including 0.2% v/v non-ionic surfactant. Addition of 28% urea ammonium nitrate (U.A.N.) at 2 L/ha will improve weed control. Plant death of target weeds may take from 1–3 weeks for visual symptoms to develop. Symptoms develop more quickly under favourable growing conditions.

TABLE 4-3. Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops

Trade Name	Guaranteed Active Concentration	GLYPHOSATE TOLERANT CROPS				WEED SPECIFIC GLYPHOSATE PRODUCT RATES (L/ac) ^c IN GLYPHOSATE TOLERANT CORN, SOYBEAN AND SUGARBEETS									
		Canola	Field Corn	Soybean	Sugarbeets	Annual Weeds	Alfalfa (Volunteer)	Dandelions (>15 cm)	Canada Thistle	Field Bindweed	Horse Nettle	Yellow Nutsedge	Perennial Sow Thistle	Wire-stemmed Muhly	Quackgrass (3-4 leaf)
CREDIT 45	450 g/L	✓	✓	✓		0.8	2.24	1.6	0.8	1.6	1.6	1.6	0.8	0.8	0.8
CREDIT PLUS	360 g/L	✓	✓	✓		1	2.8	2	1	2	2	2	1	1	1
FACTOR	356 g/L	✓	✓	✓		1	2.8	2	1	2	2	2	1	1	1
FACTOR 540	540 g/L	✓	✓	✓		0.67	1.87	1.34	0.67	1.34	1.34	1.34	0.67	0.67	0.67
GLYFOS	356 g/L	✓		✓		1	2.8	2	1	2	2	2	1	1	1
ROUNDUP ULTRA2	540 g/L	✓	✓	✓	✓	0.67	1.87	1.34	0.67	1.34	1.34	1.34	0.67	0.67	0.67
ROUNDUP WEATHERMAX	540 g/L	✓	✓	✓	✓	0.67	1.87	1.34	0.67	1.34	1.34	1.34	0.67	0.67	0.67
SHARPSHOOTER	356 g/L					1	2.8	2	1	2	2	2	1	1	1
SHARPSHOOTER PLUS	360 g/L	✓	✓	✓		1	2.8	2	1	2	2	2	1	1	1
TOUCHDOWN TOTAL	500 g/L	✓	✓	✓		0.72	2	1.44	0.72	1.44	1.44	1.44	0.72	0.72	0.72
VANTAGE PLUS	360 g/L	✓	✓	✓		1	2.8	2	1	2	2	2	1	1	1
VANTAGE PLUS MAX II	480 g/L	✓	✓	✓		0.75	2.1	1.5	0.75	1.5	1.5	1.5	0.75	0.75	0.75
WISEUP	356 g/L					1	2.8	2	1	2	2	2	1	1	1

^c For product rates that are applicable for glyphosate tolerant canola, refer to the Canola - Postemergence Grass and Broadleaf Herbicides (for use with herbicide tolerant varieties only) section in Chapter 12, page 193 for specific product rates.

✓ = Registered for application on this crop.

TABLE 4-4. Herbicide Crop Rotation and Soil pH Restrictions

For other crops, consult the label.	Field Crops																						
Trade Name	Alfalfa	Barley	Barley (Underseeded)	Beans, Kidney	Beans, White	Canola	Canola, (PURSUIT Tolerant)	Clover, Red	Corn, Field	Corn, Seed	Flax - Linseed	Oats	Oats (Underseeded)	Peanuts	Rye, Fall	Rye, Fall (Underseeded)	Soybeans	Sunflowers	Tobacco	Wheat, Spring	Wheat, Spring (Underseeded)	Wheat, Winter	Wheat, Winter (With red Clover)
	Number of months between application and planting																						
ACCENT	10	10	10	f	10	10	10	10	✓	f	f	f	f	f	f	f	10	f	f	f	f	4	10
ACCENT 1-PASS ¹	22	10	f	f	10	f	f	f	✓	f	f	f	f	f	f	f	10	f	f	f	f	f	f
ACCENT TOTAL ¹	10	10	10	f	10	10	10	10	✓	f	f	f	f	f	f	f	10	f	f	f	f	4	f
ATRAZINE <1.0 kg ai/ha	10	10	10	10	10	22	22	10	✓	✓	10	10	10	22	10	10	10	22	22	10	10	4	10
ATRAZINE > 1.0-1.5 kg ai/ha	22	10	22	22	22	22	22	22	✓	✓	10	22	22	22	10	22	10	22	22	10	22	10	22
BATTALION ¹	f	10	f	f	10	10	10	10	✓	f	f	f	f	f	f	f	10	f	f	f	f	4	10
BROADSTRIKE DUAL MAGNUM (Soil pH >7.8 and OM <2%)	10	10	f	10	10	26	26	10	10	10	f	f	f	f	f	f	✓	f	f	10	f	4	f
CALLISTO	11	10	f	f	11	f	f	22	✓	✓	f	10	f	f	4	f	11	f	f	10	f	4	f
CHATEAU	11	11	11	9	9	9	9	f	9	9	f	f	f	f	f	f	✓	9	f	8	11	4	f
CLASSIC (Soil pH 7.4 and less)	10	10	f	f	10	f	f	f	10	f	f	f	f	f	f	f	✓	f	f	f	f	3	f
CLASSIC (Soil pH 7.4-7.8)	22	22	f	f	22	f	f	f	10	f	f	f	f	f	f	f	✓	f	f	f	f	4	f
CLASSIC (Soil pH 7.8-8.0)	22	22	f	f	22	f	f	f	22	f	f	f	f	f	f	f	✓	f	f	f	f	4	f
CLEAN SWEEP ¹	22	10	22	10	10	22	10	22	10	22	22	22	22	22	22	22	✓	22	22	10	22	3.3	22
COMMAND 360 ME	16	16	16	10	10	10	10	16	10	10	16	16	16	16	16	16	✓	16	16	16	16	16	16
CONQUEST LQ ¹	22	10	22	22	22	22	22	22	10	22	22	22	22	22	22	22	✓	22	22	10	22	4	22
CONVERGE FLEXX ¹	10	10	f	f	f	10	10	f	✓	10	f	10	f	f	f	f	10	f	f	10	f	4	f
FIRSTRATE	9	f	f	9	9	26	26	f	9	f	f	f	f	9	f	f	✓	30	30	f	f	4	f

✓ = Registered for application on this crop.

f = Field bioassay; user assumes liability for all crops not indicated on the label.

¹ Herbicides sold as a co-pack under this trade name.⁴ For use only on glyphosate tolerant (Roundup Ready) field corn hybrids.**BOLD** numbers indicate that the re-crop restriction (in months) is listed on the product label.

Unbolded numbers indicate that the re-crop restriction (in months) is based on the best available information and the manufacturer of the specified product should be contacted for more information.

TABLE 4-4. Herbicide Crop Rotation and Soil pH Restrictions (cont'd)

For other crops, consult the label.	Field Crops																						
Trade Name	Alfalfa	Barley	Barley (Underseeded)	Beans, Kidney	Beans, White	Canola	Canola, (PURSUIT Tolerant)	Clover, Red	Corn, Field	Corn, Seed	Flax – Linseed	Oats	Oats (Underseeded)	Peanuts	Rye, Fall	Rye, Fall (Underseeded)	Soybeans	Sunflowers	Tobacco	Wheat, Spring	Wheat, Spring (Underseeded)	Wheat, Winter	Wheat, Winter (With red Clover)
GALAXY ¹	f	10	f	f	10	10	f	10	✓ ⁴	f	f	f	f	f	f	f	10	f	f	f	f	4	f
INFINITY	10	✓	f	f	f	10	10	f	10	f	10	10	10	f	f	f	10	f	f	✓	f	✓	f
IMPACT	f	f	f	f	10	f	f	f	✓	f	f	f	f	f	f	f	10	f	f	10	f	4	f
LONTREL	22	10	22	22	22	✓	✓	22	10	22	10	10	22	22	10	22	22	22	22	10	22	10	22
MILESTONE	48	10	10	48	48	10	10	48	10	10	10	10	10	10	f	10	48	48	48	10	10	10	10
MUSTER	22	10	f	f	22	✓	✓	22	f	f	10	10	f	f	f	f	10	f	f	10	f	4	f
OPTION 1.2.3.	10	10	10	10	10	22	22	22	✓	f	f	10	10	f	f	f	10	f	f	10	10	4	10
OPTION 2.25 OD	10	10	10	10	10	10	10	10	✓	f	f	10	10	f	f	f	10	f	f	10	10	4	10
PEAK PLUS ¹	22	10	f	f	10	f	f	f	✓	f	f	10	f	f	f	f	10	f	f	f	f	f	f
PURSUIT	✓	10	22	✓	✓	22	✓	22	10	22	22	22	22	22	22	22	✓	22	22	10	22	3.3	22
PRISM	f	10	f	f	10	10	10	10	✓	f	f	f	f	f	f	f	10	f	f	f	f	4	10
REFLEX	f	f	f	✓	✓	18	18	f	10	f	f	f	f	f	f	f	✓	f	f	10	f	4	f
SENCOR (Soil pH > 7.5)	10	10	10	10	10	22	22	10	✓	10	10	10	10	10	10	10	✓	10	22	10	10	3.3	10
SIMAZINE/PRINCEP <2 kg ai/ha	✓	10	10	22	22	22	22	22	✓	10	22	10	10	10	10	10	22	22	22	10	10	10	10
SIMAZINE/PRINCEP >2 kg ai/ha	✓	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22	22	22	22	22	22	22
ULTIM	f	10	f	f	10	10	10	10	✓	f	f	f	f	f	f	f	10	f	f	f	f	4	f
ULTIM TOTAL ¹	f	10	f	f	10	10	10	10	✓	f	f	f	f	f	f	f	10	f	f	f	f	4	f
VALTERA	11	11	11	9	9	9	9	f	9	9	f	f	f	f	f	f	✓	9	f	8	11	4	f

✓ = Registered for application on this crop.

f = Field bioassay; user assumes liability for all crops not indicated on the label.

¹ Herbicides sold as a co-pack under this trade name.⁴ For use only on glyphosate tolerant (Roundup Ready) field corn hybrids.**BOLD** numbers indicate that the re-crop restriction (in months) is listed on the product label.

Unbolded numbers indicate that the re-crop restriction (in months) is based on the best available information and the manufacturer of the specified product should be contacted for more information.

TABLE 4-5. Herbicide Crop Rotation and Soil pH Restrictions

For other crops, consult the label.	Horticultural Crops																											
Trade Name	Asparagus	Beans, Lima	Beans, Snap	Beets, Red	Beets, Sugar	Broccoli	Brussels Sprouts	Cabbage	Carrots	Cauliflower	Celery	Corn, Sweet	Cucumber	Garlic	Herbs	Lettuce	Muskmelon	Onions	Parsnips	Peas	Peppers	Potatoes	Pumpkin	Rutabaga	Spinach	Squash	Tomatoes (Transplanted)	Watermelon
	Number of months between application and planting																											
ACCENT	f	f	f	f	f	f	f	10	f	f	f	✓	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
ACCENT 1-PASS ¹	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
ACCENT TOTAL ¹	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
ATRAZINE <1.0 kg ai/ha	22	10	10	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	10	22	10	22	22	22	22	10	22
ATRAZINE >1.0–1.5 kg ai/ha	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
BATTALION ¹	f	f	f	f	10	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
BROADSTRIKE DUAL MAGNUM (Soil pH >7.8 and OM <2%)	f	10	10	f	f	f	f	f	f	f	f	22	22	f	f	f	f	f	f	10	22	22	f	f	f	f	26	f
CALLISTO	f	22	22	f	f	f	f	f	f	f	f		f	f	f	f	f	f	f	22	f	11	f	f	f	f	11	f
CHATEAU	✓	9	9	f	f	f	f	f	f	f	f	f	f	f	f	f	f	✓	f	f	f	✓	f	f	f	f	f	f
CLASSIC (Soil pH 7.0 and less)	f	f	f	f	f	f	f	11	f	f	f	11	f	f	f	f	f	f	f	11	f	f	f	f	f	f	12	f
CLASSIC (Soil pH 7.0 to 8.0)	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	12	f
CLEAN SWEEP ¹	22	22	22	f	f	22	22	22	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22
COMMAND 360 ME	16	16	10	16	16	10	16	16	16	16	16	10	10	16	16	16	16	16	16	10	10	10	10	16	16	10	16	16
CONQUEST LQ ¹	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
CONVERGE FLEXX ¹	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f
FIRSTRATE	f	f	9	9	f	f	f	f	f	f	f	18	f	f	f	f	f	f	f	9	f	f	f	f	f	f	f	f
GALAXY ¹	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
INFINITY	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
IMPACT	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f

✓ = Registered for application on this crop.

¹ Herbicides sold as a co-pack under this trade name.

f = Field bioassay; user assumes liability for all crops not indicated on the label.

BOLD numbers indicate that the re-crop restriction (in months) is listed on the product label. Unbolded numbers indicate that the re-crop restriction (in months) is based on the best available information and the manufacturer of the specified product should be contacted for more information.

TABLE 4-5. Herbicide Crop Rotation and Soil pH Restrictions (cont'd)

For other crops, consult the label.	Horticultural Crops																											
Trade Name	Asparagus	Beans, Lima	Beans, Snap	Beets, Red	Beets, Sugar	Broccoli	Brussels Sprouts	Cabbage	Carrots	Cauliflower	Celery	Corn, Sweet	Cucumber	Garlic	Herbs	Lettuce	Muskmelon	Onions	Parsnips	Peas	Peppers	Potatoes	Pumpkin	Rutabaga	Spinach	Squash	Tomatoes (Transplanted)	Watermelon
LONTREL	22	22	22	22	f	✓	22	✓	22	✓	22	22	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22
MILESTONE	f	48	48	f	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	48	48	f	f	f	f	f	48	f
MUSTER	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
OPTION 1.2.3.	f	f	f	f	22	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
OPTION 2.25 OD	f	f	f	f	10	f	10	10	f	f	f	10	f	f	f	f	f	f	f	10	f	10	f	f	f	f	f	f
PEAK PLUS ¹	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f
PRISM	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	✓	f	f	f	f	✓	f
PURSUIT	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22
REFLEX	f	f	✓	18	18	18	18	18	f	18	f	18	f	f	f	f	f	f	f	f	f	f	f	18	f	f	f	f
SENCOR (Soil pH > 7.5)	✓	10	10	22	22	22	22	22	10	22	22	10	22	10	10	22	22	22	10	10	22	✓	22	22	22	22	22	22
SIMAZINE/PRINCEP <2 kg ai/ha	22	22	22	10	22	22	22	22	22	22	22	10	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
SIMAZINE/PRINCEP >2 kg ai/ha	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
ULTIM	f	f	f	f	10	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	10	f	f	f	f	f	10	f
ULTIM TOTAL ¹	f	f	f	f	10	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	10	f	f	f	f	f	10	f
VALTERA	12	9	9	f	f	f	f	f	f	f	f	f	f	f	f	f	f	12	f	f	f	12	f	f	f	f	f	f

✓ = Registered for application on this crop.

¹ Herbicides sold as a co-pack under this trade name.

f = Field bioassay; user assumes liability for all crops not indicated on the label.

BOLD numbers indicate that the re-crop restriction (in months) is listed on the product label.

Unbolded numbers indicate that the re-crop restriction (in months) is based on the best available information and the manufacturer of the specified product should be contacted for more information.

FIELD BIOASSAY SERVICE:

A&L Laboratories provides a bioassay service to assist in making re-crop decisions.

For More Information Contact:A&L Laboratories Canada Ltd., 2136 Jet Stream Road,
London, ON-N5V 3P5
www.alcanada.com

TABLE 4-6. Herbicide Groupings for Ontario

Gr ¹	Site of Action	Single Modes of Action (alphabetic order)	Confirmed Herbicide Resistant Weeds in Ontario (As of Dec, 2009)
1	Inhibitors of acetyl CoA carboxylase (ACCase)	ACCLAIM SUPER, ACHIEVE, ASSURE II, EXCEL SUPER, POAST, PUMA ADVANCE, PUMA ¹²⁰ SUPER, SELECT, ULTRA, VENTURE	Currently none confirmed.
2	Inhibitors of acetolactate synthase (ALS) and also called acetohydroxy-acid synthase (AHAS)	ACCENT, ARSENAL, CLASSIC, ELIM EP, FIRSTRATE, MUSTER, OPTION 2.25 OD, PINNACLE, PRISM, PURSUIT, REFINO SG, TELAR, ULTIM, UPBEET	Cocklebur, common ragweed, Eastern black nightshade, giant foxtail, green foxtail, green pigweed, lamb's-quarters, redroot pigweed, waterhemp.
3	Microtubule assembly inhibitors	BONANZA, DACTHAL W-75, DIMENSION, PROWL, RIVAL, TREFLAN	Currently none confirmed.
4	Synthetic auxins	2,4-D, BANVEL II, CALIBER, COBUTOX, COMPITOX, COVITOX PLUS, DESORMONE, DIPHENOPROP, DYCLEER, DYVEL, EMBUTOX, ESTAPROP PLUS, GARLON, IPCO DICHLORPROP-D, IPCO PREMIUM 2-WAY XP TURF HERBICIDE, KILLEX, LONTREL, MCPA, MECOPROP, MECOCROP 2,4-D, MECO-D, PAR III, IPCO PREMIUM 3-WAY XP TURF HERBICIDE, RELEASE, SWORD, TARGET, TOPSIDE, TORDON 101, TROPHY, TURF-RITE 2+2, TURBOPROP, VANQUISH	Wild carrot.
5	Inhibitors of photosynthesis at photosystem II, Site A	AATREX LIQUID 480, ATRAZINE, GESAGARD, HYVAR X, PRINCEP, PRONONE, PYRAMIN FL, SENCOR, SIMADEX, SIMAZINE, SINBAR, VELPAR	Barley grass, common groundsel, common lamb's-quarters, common ragweed, goosefoot, redroot pigweed, waterhemp, wild mustard, witch grass, yellow foxtail.
6	Inhibitors of photosynthesis at photosystem II, Site B	BASAGRAN, BASAGRAN FORTÉ, KORIL, PARDNER, BROTOX	Green pigweed.
7	Inhibitors of photosynthesis at photosystem II, Site B (alternate binding site)	DIUREX 80W, KARMEX, LOROX	Green pigweed, smooth pigweed.
8	Conjugation of acetyl co-enzyme A	BETASAN, ERADICANE, EPTAM, RO-NEET	Currently none confirmed.
9	Inhibitors of 5-enolpyruvylshikimate-3-phosphate synthase (EPSP)	CREDIT, CREDIT PLUS, EZJECT, FACTOR, FACTOR 540, GLYFOS, MAVERICK III, ROUNDUP ULTRA II, ROUNDUP WEATHERMAX, SHARPSHOOTER, SHARPSHOOTER PLUS, TOUCHDOWN TOTAL, VANTAGE, VANTAGE PLUS, VANTAGE PLUS MAX, VANTAGE PLUS MAX II, VISION, VISION MAX	Currently none confirmed.
10	Inhibitors of glutamine synthetase	IGNITE, LIBERTY	Currently none confirmed.
11	Inhibitors of carotenoid biosynthesis	AMITROL	Currently none confirmed.
13	Diterpene synthesis inhibitor	COMMAND 360	Currently none confirmed.
14	Inhibitors of protoporphyrinogen oxidase (Protox)	AIM EC, BLAZER, GOAL, REFLEX, VALTERA	Currently none confirmed.
15	Conjugation of acetyl co-enzyme A	DEVIRINOL, DUAL MAGNUM, DUAL II MAGNUM, FRONTIER MAX	Currently none confirmed.
19	Inhibitors of auxin transport system	ALANAP	Currently none confirmed.
20	Inhibits cell wall synthesis, Site A	CASORON	Currently none confirmed.
22	Photo system I – electron diverters	GRAMOXONE, REGLONE, REWARD	Canada fleabane, field peppergrass.
27	Inhibitors of p-hydroxyphenyl pyruvate dioxygenase (HPPD)	CALLISTO, CONVERGE FLEXX, IMPACT	Currently none confirmed.

¹ Herbicide groupings for Ontario follow the Weed Science Society of America's nationally accepted grouping. Groups 12, 13, 16, 17, 18, 21, 24, 25 and 26 are not available in Ontario.

² Products with two or more sites of action are followed by the group numbers involved. ³ Indicates herbicides sold as a co-pack under this trade name.

TABLE 4-6. Herbicide Groupings for Ontario (cont'd)

Herbicide Groupings for Pre-Mix and "Co-Pack" Products

Premix or "Co-Pack" Trade Name	Component #1 (WSSA Group)	Component #2 (WSSA Group)	Component #3 (WSSA Group)
ACCENT 1-PASS ³	ACCENT (2)	PEAK (2)	Banvel II (4)
ACCENT TOTAL ³	ACCENT (2)	DISTINCT (4)	
BATTALION ³	ELIM EP (2)	BANVEL II (4)	Dual II Magnum (15)
BOUNDARY ³	SENCOR (5)	DUAL II MAGNUM (15)	
BROADSTRIKE DUAL MAGNUM	flumetsulam (2)	metolachlor (15)	
BUCTRL M, BADGE, LOGIC M or MEXTROL	MCPA (4)	bromoxynil (6)	
CLEANSWEEP ³	PURSUIT (2)	BASAGRAN FORTÉ (6)	
CONQUEST LQ ³	PURSUIT (2)	SENCOR (5)	
CONVERGE XT ³	CONVERGE 480 (5)	CONVERGE FLEXX (27)	
DISTINCT	dicamba (4)	diflufenzopyr (19)	
GALAXY ³	ELIM EP (2)	ROUNDUP WEATHERMAX (9)	
GUARDIAN ³	CLASSIC (2)	TOUCHDOWN TOTAL (9)	
HALEX GT	glyphosate (9)	mesorione (27)	s-metolachlor/benoxacor (15)
INFINITY	bromoxynil (6)	pyrasulfotole (27)	
KROVAR	bromacil (5)	diuron (7)	
LADDOK	atrazine (5)	bentazon (6)	
MARKSMAN, PROPERO	dicamba (4)	atrazine (5)	
PEAKPLUS ³	PEAK (2)	BANVEL II (4)	
PRIMEXTRA II MAGNUM	atrazine (5)	s-metolachlor/benoxacor (15)	
SHOTGUN	2,4-D (4)	atrazine (5)	
TROPHY	TROPHY A (4)	TROPHY B (4)	
ULTIM TOTAL ³	ULTIM (2)	DISTINCT (4)	

¹ Herbicide groupings for Ontario follow the Weed Science Society of America's nationally accepted grouping. Groups 12, 13, 16, 17, 18, 21, 24, 25 and 26 are not available in Ontario.

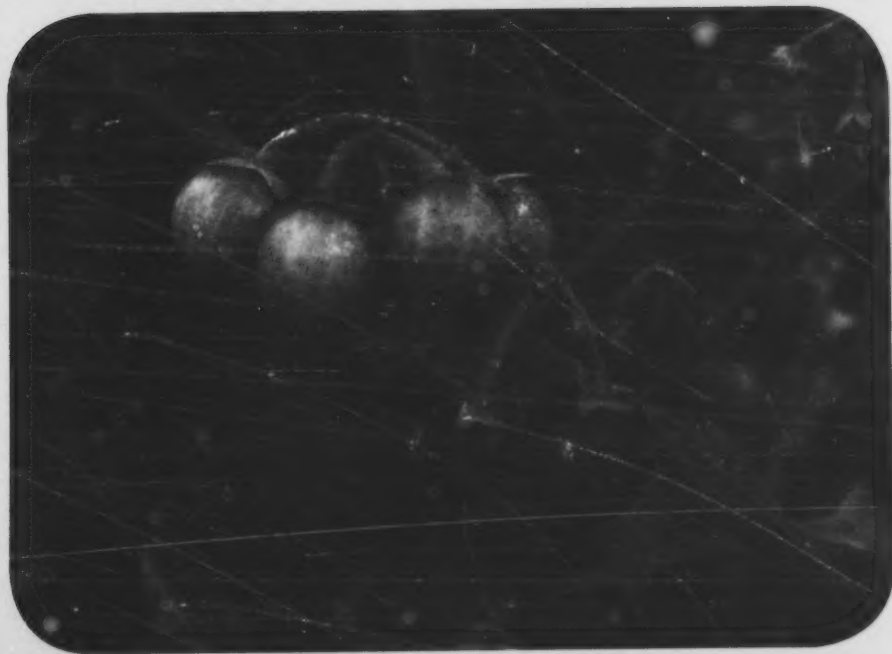
² Products with two or more sites of action are followed by the group numbers involved. ³ Indicates herbicides sold as a co-pack under this trade name.

TABLE 4-7. Interval Before Rainfall (Postemergence)

Rainfall shortly after application of a postemergence herbicide may reduce the weed control. This effect varies with the product, the formulation, the interval of time and the drying conditions between application and rainfall, as well as on the amount, intensity and duration of rainfall. The following information is based on label information and additional detail supplied by the chemical industry. For further information, contact the manufacturer. In the case of a tank-mix, use the longest time interval of the products being considered.

0 to 15 Minutes	1 Hour	2 Hours	3 Hours	4 Hours	4 Hours (cont'd)	6 Hours
DIMENSION	ACHIEVE	2,4-D Ester	ACCLAIM SUPER	2,4-D amine	PEAKPLUS ¹	AMITROL 240
GRAMOXONE	ASSURE II	ACCENT	CALLISTO	ACCENT 1-PASS ¹	PINNACLE	BASAGRAN
REGLONE DESICCANT	BADGE	AIM EC or CLEANSTART PLUS	GOAL 2XL	ACCENT-TOTAL ¹	PROPERO	BASAGRAN FORTÉ
REWARD	BROTEX	atrazine	SWORD	BANVEL II	REFINE M	BLAZER
	BUCTRIL M	CLASSIC	TARGET	BATTALION ¹	REFLEX	CLEANSWEEP ¹
	CALIBER	DICHLORPROP D		CLOVITOX PLUS	SAVAGE	CREDIT
	COBUTOX	ESTAPROP PLUS		CREDIT PLUS	TORDON 101	FACTOR 540
	ECOCLEAR	FIRSTRATE		DISTINCT	TRANSLINE	GLYFOS
	EMBUTOX	GALAXY ¹		DYCLEER	TROPOTOX PLUS	LADDOK
	EXCEL SUPER	IMPACT		DYVEL	TOPSIDE	MCPA sodium
	HALEX GT	MCPA ester		IGNITE	TROPHY ¹	PYRAMIN FL
	INFINITY	OPTION 2.25 OD and OPTION 1.2.3.		LIBERTY 200 SN	UPBEET	ROUNDUP
	KORIL	PRISM		LONTREL	VANQUISH	SENCOR
	MEXTROL	PURSUIT		MARKSMAN	VANTAGE PLUS	VANTAGE
	PARDNER	SHOTGUN		MCPA amine		
	POAST ULTRA	TORDON 101		MUSTER		
	PUMA ¹²⁰ SUPER	TURBOPROP				
	REFINE SG	ULTIM				
	ROUNDUP ULTRA2 and WEATHERMAX	VENTURE L				
	SELECT					
	TOUCHDOWN TOTAL					
8 Hours	24 Hours					
LOROX	MECOTURF plus 2,4-D					

¹ Indicates herbicides sold as a co-pack under this trade name.



5. NOTES ON ADJUVANTS

Introduction

An adjuvant is any substance added to a spray solution to modify and enhance the effectiveness of the herbicide.

Adjuvants are an important part of the spray solution and if not used will negatively affect the degree of weed control obtained. Some products have adjuvants formulated into the product while other products require that the user add the adjuvant. The selection of adjuvants is key to obtaining the right balance between maximizing weed control and minimizing crop injury. In some cases the rate of adjuvant varies depending on conditions of weather, crop stage, weed species, water quality, etc. Some herbicide labels recommend particular adjuvant products and some recommend particular types of adjuvants. Always use adjuvants as directed on the product label.

Most adjuvant recommendations in this guide are listed as the amount (in litres) added to 1,000 L (L/1,000 L) of spray solution. If you wish to convert to % volume/volume (v/v) use the following conversion:

$$10 \text{ L}/1,000 \text{ L} = 1 \% \text{ v/v}$$

There are two broad categories of adjuvants:

- activators and spray modifiers, and
- utility modifiers.

Activators and Spray Modifiers

- **Surfactants** (also known as "surface active agents") are the largest class of adjuvants. Surfactants can be non-ionic, anionic, cationic or amphuteric. Most surfactants are non-ionic (NIS); that is they do not ionize. A NIS is used to enhance herbicide

penetration into a waxy cuticle. Wetting agents and detergents are primarily anionic and when ionized in solution, the water soluble portion is negatively charged. Cationic surfactants exhibit a net positive charge in solution. Amphuteric surfactants can be either anionic or cationic. Cationic and amphuteric surfactants are not widely used in agricultural chemicals.

- **Oils** solubilize the waxy cuticle layer on a weed leaf surface to increase spray penetration through the leaf cuticle. Oils are refined mineral oils (petroleum based) or seed oils. Seed oils are categorized as triglycerides, methylated seed oils (MSO) or crop oil concentrates (COC). Crop oil concentrates are a combination of seed oil and surfactants.
- **Spreaders** are wetting agents that reduce the surface tension to create better contact between the spray solution and the treated surface (leaf, etc.). A sticker increases the herbicide adhesion to the leaf surface.

Utility Modifiers

- **Compatibility** agents improve mixing, especially when using a liquid fertilizer carrier.
- **Drift control** agents increase the droplet size to reduce drift.
- **Anti-foaming/Defoaming** agents are used to reduce and prevent foaming in the spray tank.
- **Foaming** agents are used with specialized equipment to produce and apply foam.
- **Buffering** agents can be used to enhance solubility or adjust pH.
- **Dyes are used** in some instances to enhance visibility of spray foam solutions.

Note

Read the following notes together with the recommendations given later in this publication. Additional information on use, toxicity and safety precautions is given here. With a few exceptions the adjuvants are listed under their trade or product name. See Table 5-1. *Adjuvants Used in Ontario*, on page 75 for a summary of adjuvants listed in this publication.

Complete information on each adjuvant is available on the product label which is located on the product container. The federal Pest Management Regulatory Agency also lists pesticide labels on their website at: www.pmr-arla.gc.ca.

Many pesticide manufacturers also list product labels and/or Material Safety Data Sheets (MSDS) on their websites that are listed on the last page of this publication.

AGRAL 90

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Nonylphenoxy polyethoxyethanol 90%.

Registered Uses: For use with REGLONE, glyphosate*, PURSUIT, ACCENT, ULTIM and other products as labeled. Also used for washing sprayer tanks and equipment.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

Mixing: Use 200–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water. Add

AGRAL 90 to the spray mixture and agitate thoroughly. With glyphosate, use 350 mL/50–100 L water if targeting quackgrass in minimum or zero tillage seeding and summerfallow uses. Use 500 mL/100L for quackgrass when water volumes are high (i.e. 150 to 300 L/ha).

Unique Characteristics: Do not exceed the recommended rates of AGRAL 90 as too much wetting agent can lead to loss of spray due to excessive run-off.

AG-SURF

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Nonylphenoxy polyethoxyethanol 92%.

Registered Uses: For use with glyphosate, PURSUIT and other products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.

Mixing: For use with ROUNDUP: when applying the 2.5 L/ha of water, add AG-SURF at 0.5% (0.50 L/100 L water) to maintain adequate surfactant concentration. For use with ROUNDUP to control annual grasses and broadleaf weeds for minimum or zero-till: use 350 mL/ha plus ROUNDUP at 1.1 L/ha in 50–100 L/ha of clean water.

Unique Characteristics: Do not exceed recommended rates of AG-SURF, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

ALLIANCE 400

Type of Adjuvant: Compatibility agent.

Chemical Composition: Aliphatic phosphate ester, isopropanol and glycol ethers 69%.

Benefit: Emulsifies and disperses liquid fertilizers and emulsifiable pesticides in solution to produce uniform tank-mixes.

Mixing: Mix 60–375 mL of Alliance/100 L of solution depending on fertilizer and number of pesticides. Add alliance to the fertilizer solution before the pesticide.

AMIGO

Type of Adjuvant: Surfactant.

Chemical Composition: 30% phosphate ester surfactant.

Registered Uses: For use with SELECT and SELECT tank-mixes.

Benefit: Improves chemical effectiveness under varying environmental conditions.

Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact area. Enhances penetration of herbicide through the leaf cuticle layer.

Mixing: Half-fill spray tank with water and start agitation. Add the correct amount of herbicide, agitate and then add the correct amount of AMIGO with the remaining water. Continue to agitate.

AQUASOFT

Type of Adjuvant: Water conditioning agent.

Chemical Composition: Proprietary blend of hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid 63%.

Benefit: Eliminates hard water antagonism as well as formulation instability due to high pH.

Mode of Action: Conditions water by sequestering and chelating hard water ions and reducing the pH.

Mixing: 100–750 mL/100 L of spray solution, depending on water hardness. Always check compatibility with a jar test.

AQUA-STABLE

Type of Adjuvant: Buffering agent.

Chemical Composition: Aliphatic polycarboxylate and calcium chloride 28%.

Benefit: Lowers the pH of the spray water and reduces pesticide breakdown from alkaline spray solutions.

Mode of Action: Acidifies and buffers spray solution.

Mixing: 60–250 mL/100 L of spray solution, depending on the PPM alkalinity.

ASSIST OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal).

Chemical Composition: 83% paraffin base mineral oil plus 17% surfactant blend.

Registered Uses: ASSIST OIL CONCENTRATE is registered for use with BASAGRAN, IMPACT, LADDOK and atrazine.

Benefit: Using ASSIST results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. ASSIST also aids in providing a faster weed kill.

Mode of Action: Reduces the evaporation of spray droplets on the leaf surface leading to a longer period for penetration. Improves penetration through the leaf cuticle layer. ASSIST also aids in spreading a spray droplet on the leaf surface so that it covers a greater surface area.

Mixing: Half-fill the spray tank with water and begin agitation. Add the desired amount of herbicide and continue filling. Add ASSIST last. After filling, continue agitation. Agitate thoroughly after any stoppage in spraying.

Unique Characteristics: May cause increased temporary topical burn to crop plants under hot, humid weather conditions.

BREAKER

Type of Adjuvant: Antifoamer/defoamer.

Registered Uses: To reduce foaming when preparing herbicide spray mixes.

Benefit: Small quantities of BREAKER added before adding herbicides will prevent foam from forming.

Mixing: Add 7 mL/500 L of spray mix.

Unique Characteristics: Can be added after foam has formed but more time will be required to eliminate the foam.

BUFFERING AGENTS

See AQUA-STABLE.

CHOICE

Type of Adjuvant: Water conditioning agent.

Chemical Composition: Blend of polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate.

Benefit: Eliminates "hard water antagonism" and instability due to high pH.

Mode of Action: Conditions water by sequestering or chelating hard water ions and by the reduction in pH.

Mixing: 2.5–7.5 L/1,000 mL water.

COMPANION

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Octylphenoxy-polyethoxy-(9)-ethanol 70%.

Registered Uses: glyphosate, TELAR, MUSTER and other products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

Mixing: With glyphosate, for the control of annual grasses and broadleaf weeds, add 450 mL of COMPANION in 50–100 L of water/ha. With TELAR, add 100 mL of COMPANION to 100 L of water for the control of broadleaf weeds. Use constant agitation.

Unique Characteristics: Do not exceed the recommended rates of COMPANION as too much may reduce the effectiveness of the herbicide due to excessive run-off.

COMPATABILITY AGENTS

See ALLIANCE 400, UNITE.

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, on page 23 for a complete list of products.

DEFOAMERS/ANTIFOAMERS

See BREAKER, FIGHTER F, FLAT-OUT, HALT, VALID, ZAP.

DRIFT-CONTROL AGENTS

See ON-TARGET, VALID.

DYES

See IN-SIGHT.

ENHANCE NON-IONIC SPRAY ADJUVANT

Type of Adjuvant: Non-ionic multipurpose adjuvant.

Chemical Composition: Triglyceride Ethoxylate 80%.

Registered Uses: ENHANCE can be used with glyphosates*, REGLONE, PURSUIT, ACCENT, ULTIM, REFINE and a wide range of other products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: ENHANCE works by several modes of action which results in improving wetting, spreading and penetrative properties.

Mixing: Use 200–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water. Add AGRAL 90 to the spray mixture and agitate thoroughly. For use with ROUDNUP and other glyphosates use 350 mL/50 – 100L for quackgrass, minimum or zero tillage seeding and summerfallow Uses. Use 500 mL/100L for quackgrass for water volume of 150 to 300 L/ha.

Unique Characteristics: ENHANCE contains no non-ylphenoxy polyethoxy ethanol (NPE's). Do not exceed recommended rates of ENHANCE as this may cause run-off.

FIGHTER F

Type of Adjuvant: Antifoamer-defoamer.

Chemical Composition: Dimethyl-polysiloxane 10%.

Registered Uses: To control foam in water, oil, fertilizer and pesticide spray mixtures.

Benefit: Controls foam when mixing sprays, eliminates material waste, provides more accurate metering of agricultural sprays, and eliminates foam overflow at fill site.

Mixing: To control foam when mixing spray solution, add defoamer either just before or during addition of any other spray adjuvant. To cut existing foam, add defoamer to tank and recirculate solution until foam dissipates.

FLAT-OUT

Type of Adjuvant: Antifoamer-defoamer.

Chemical Composition: Dimethylpolysiloxane 20% silicone base neutral.

Registered Uses: To control foam formation or existing foam, use as premix or add while spray tank is being filled.

Benefit: The reduction of foam allows for faster tank fill, ensures fill volumes are correct and reduces the possibility of chemical overflow, therefore more accurate application. It also makes the cleaning process easier.

Mixing: Add 5–10 mL/100 L of solution. Adjust the amount required according to individual conditions. May be used before mixing to prevent foam, or after to cut foam. May be used with any herbicide unless contra-indicated on the label.

FOAM MARKERS

See TRAMLINE, TREKKER TRAX.

HALT

Type of Adjuvant: Defoamer.

Chemical Composition: Silicone base, neutral.

Registered Uses: To reduce foaming when preparing herbicide spray mixes.

Benefit: The reduction of foaming allows faster tank fill-ups, ensures correct fill volumes, reduces the possibility of chemical overflow and gives more accurate herbicide application.

Mixing: Add 7 mL/500 L of spray mix. May be added to spray tank during filling to prevent foaming, or after to cut foam.

Unique Characteristics: May be used with any herbicide unless otherwise stated on the product label.

HASTEN NT

Type of Adjuvant: Non-ionic esterified vegetable oil.

Chemical Composition: Methyl and ethyl oleate 71.44%.

Registered Uses: For use with REFINE SG.

Benefit: Improves herbicide uptake.

Mixing: Use 5 L/1000 L of spray solution.

IN-SIGHT

Type of Adjuvant: Foam Marker Dye.

Active Ingredients: Dye, Surfactants, and Coupling Agents.

Uses: As a colour dye marker for foam markers and as a dye marking agent for turf applications.

Benefit: Allows foam marking systems to show up under poor visibility conditions of low light, heavy trash, no-till, snow or fog.

Mixing: Use 15–30 mL/100 L of spray solution.

KORNOIL

Type of Adjuvant: Mineral oil (non-herbicidal).

Chemical Composition: 98.5% mineral oil, 1.5% emulsifier.

Registered Uses: (Crop/herbicide): Corn/atrazine.

Benefit: Improved postemergence activity of atrazine.

Mode of Action: Partially dissolves waxy cuticle of weeds allowing atrazine to penetrate more readily.

Mixing: Fill spray tank with water allowing space for subsequent addition of atrazine and oil; engage agitation and pour in premixed slurry of atrazine in water; add KORNOIL last. Avoid excessive agitation of the spray mix as this may cause coagulation or buttering out.

Unique Characteristics: To prevent a build-up of oil in the sprayer, empty the tank as completely as possible

before refilling. Some injury may occur if the crop is stressed (cold weather or hot, dry weather).

KORNOIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal).

Chemical Composition: Paraffin-base mineral oil 85%, surfactant blend 15%.

Registered Uses: To be blended with atrazine/water mixtures and applied postemergence in corn.

Benefit: Improved postemergence activity of atrazine.

Mode of Action: Partially dissolves waxy cuticle of weeds allowing atrazine to penetrate more readily. Also reduces evaporation and aids in spreading of spray droplets on the leaf surface leading to a longer period for penetration.

Mixing: Avoid violent agitation; partially fill sprayer, add atrazine slurry, add KORNOIL CONCENTRATE last.

Unique Characteristics: Some injury may occur with cold, rainy weather.

LI700

Type of Adjuvant: Non-ionic surfactant and pH Adjuster/Acidifier.

Chemical Composition: Phosphatidylcholine, methylacetic acid and alkyl polyoxyethylene ether 80%.

Registered Uses: As a penetrating surfactant; as a pH adjuster/acidifier; for use with glyphosate products. LI700 neutralizes or slightly acidifies the spray solution and prevents the breakdown hydrolysis of pH-sensitive products in the spray tank. Add LI700 before adding the pesticide.

Benefit: Improves chemical effectiveness.

Mixing: As a penetrating surfactant: Use 5 L of 1,000 L spray mixture or 500 mL of 100 L spray mixture. As a pH adjuster/acidifier: highly alkaline water, (pH 8 or higher). Use: 625 mL–1.25 L/1,000 L water mixture.

MERGE

Type of Adjuvant: Surfactant/solvent.

Chemical Composition: 50% surfactant blend plus 50% solvent (petroleum hydrocarbons).

Registered Uses: For use with POAST ULTRA.

Benefit: Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions.

Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer. Acts as a protectant against photodegradation of POAST ULTRA by UV light.

Mixing: Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add MERGE, along with remaining water, last to the tank. Agitate thoroughly after any stoppage in spraying.

Unique Characteristics: May cause temporary topical burn to crop plants under hot, humid weather conditions.

MINERAL OIL/SURFACTANT (NON-HERBICIDAL)

See ASSIST OIL CONCENTRATE, KORNOIL, KORNOIL CONCENTRATE, XA OIL CONCENTRATE.

OIL

See MINERAL OIL.

ON TARGET

Type of Adjuvant: Deposition aid/drift control agent.

Chemical Composition: Polyvinyl polymer (polyacrylamide) 30%.

Registered Uses: For use with most water soluble and wettable powder pesticides and desiccants, including glyphosate, when applied by aerial application or standard ground equipment.

Benefit: Deposition improvement and drift retardation in spraying operations, to potentially reduce injury to adjacent crops or plants.

Mode of Action: When tank-mixed with a pesticide ON TARGET reduces drift by materially reducing fines resulting from shear.

Mixing: Fill mix tank with water, pesticide and other additives and begin to agitate. Select correct dosage, shake bottle well before using, either inject ON TARGET liquid into the suction side of the feeder or recirculating pump or slowly add ON TARGET liquid to the rapidly agitating tank-mix in the area of highest turbulence by pouring a very thin stream. This obtains the best dispersion of the polymer throughout the pesticide solution. Allow mixing to continue for at least 2 minutes before spraying.

PRO-SURF II

Type of Adjuvant: Non-ionic liquid spreader/activator.

Chemical Composition: Alkylarylpoloxyethylene glycols, free fatty acids and isopropyl alcohol; 900g/L.

Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, ULTIM, and other products as labeled.

Benefit: Improves spray chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.

Mixing: Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the PRO-SURF II, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to insure a uniform spray.

Unique Characteristics: Do not exceed recommended rates of PRO-SURF II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

SIDEKICK II

Type of Adjuvant: Non-ionic liquid spreader/activator.

Chemical Composition: Alkylarylpoloxyethylene glycols, free fatty acids and isopropyl alcohol; 900G/L.

Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, ULTIM and other products as labelled.

Benefit: Improves spray chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.

Mixing: Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the SIDEKICK II, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to insure a uniform spray.

Unique Characteristics: Do not exceed recommended rates of SIDEKICK II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

SUPER SPREADER

Type of Adjuvant: Non-ionic spreader sticker surfactant.

Chemical Composition: Octyl phenoxy poly ethoxy ethanol 50%.

Registered Uses: For use with ACCENT, atrazine, BASAGRAN, MUSTER, PINNACLE, TELAR, PRISM, PYRAMIN FL, REFINE EXTRA, REFLEX, ULTIM and other products as labelled.

Benefit: Improves postemergence control of weeds that have reached their upper limit in size for susceptibility.

Mode of Action: Causes the spray mix to form a continuous film on leaf surfaces; also makes herbicide more rainfast.

Mixing: Use 1-2.5 L/ha. Half-fill tank with water; add herbicide with continuous agitation; complete fill-

ing of tank with water; add SUPER SPREADER STICKER with continuous agitation.

Unique Characteristics: Higher rates are required with hard water.

SURE-MIX

Type of Adjuvant: Paraffinic petroleum oil/surfactant (non-herbicidal).

Chemical Composition: 60% Paraffinic petroleum oil plus 35.6% surfactant blend.

Registered Uses: SURE-MIX is registered for use with ASSURE II, and CLASSIC plus PINNACLE when tank-mixed with ASSURE II.

Benefit: The use of SURE-MIX results in improved activity of ASSURE II and a greater degree of consistency under varying environmental conditions.

Mode of Action: Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets thus improving penetration through the cuticle of leaf surfaces.

Mixing: Add the required amount of water to the spray tank with agitator running. Add ASSURE II and after well mixed add 5 L of SURE-MIX for each 1,000 L of spray solution.

Unique characteristics: May cause some minor leaf speckling under hot and humid weather conditions.

SURFACTANTS

See AGRAL 90, AG-SURF, COMPANION, ENHANCE, HASTEN NT, LI700, MERGE, PRO-SURF II, SIDEKICK II, SUPER SPREADER, SYLGARD 309, XA OIL CONCENTRATE.

SYLGARD 309

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Siloxylated polyether 76% plus surfactant mixture 24%.

Registered Uses: For use with PURSUIT on soybeans for annual broadleaf and grass control; and glyphosate for quack grass control and annual broadleaf

weed control in summer fallow; and with TORDON 101 for faster burndown of coniferous species on right-of-ways, BASAGRAN on soybeans, RETAIN PLANT GROWTH REGULATOR, VISION SILVICULTURE and VISION MAX SILVICULTURE, VANTAGE FORESTRY, RANMAN 400 SC, FULFILL 50 WG

Benefits: Improves chemical effectiveness by increasing the amount and rate of uptake of water-soluble herbicides.

Mixing: Use 2.5 L/1,000 L of spray solution for most applications; add this amount last to the spray tank after the herbicide has been thoroughly mixed. Apply the spray solution as soon as possible after mixing.

Unique Characteristics: This organosilicone formulation has lowest surface tension of any adjuvant available.

TRAMLINE

Type of Adjuvant: Foam marker.

Chemical Composition: Nonionic and anionic surfactants, 35% plus 65% alcohols and other constituents

Benefit: Improves placement of herbicides by indicating area of field sprayed, preventing overlaps and misses.

Mixing: Depending on water hardness and mineral content mix 0.63–1 L/100 L of water.

TREKKER TRAX

Type of Adjuvant: Foam marker.

Chemical Composition: 24% alcohols and 30% mixed anionic and nonionic surfactants.

Benefit: Improves placement of herbicides by indicating area of field sprayed.

Mixing: Depending on water hardness, use 1–2 L/100–150 L water.

TURBOCHARGE

Type of Adjuvant: Surfactant/solvent.

Chemical Composition: 39.5% surfactant blend plus 50% solvent (mineral oil).

Registered Uses: For use with ACHIEVE 40 DG herbicide.

Benefit: Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions.

Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer.

Mixing: Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add TURBOCHARGE along with remaining water last to the tank. Agitate thoroughly after any stoppage in spraying. Use at a rate of 0.5 L TURBOCHARGE/100 L of spray mixture. If tank-mixing with other herbicides, always add the TURBOCHARGE last.

UNITE

Type of Adjuvant: Compatibility agent.

Chemical Composition: 83.7% acid polyglycols and methyl alcohol.

Benefit: Improves the compatibility of liquid fertilizer-pesticide mixtures.

Mixing: 240–1,420 mL/378.5 L. Perform a test of physical compatibility of various pesticides and fertilizer mixtures in a small quantity to determine the exact amount of UNITE and the mixing method to be used.

VALID

Type of Adjuvant: Deposition and drift reduction agent, antifoam-defoamer.

Chemical Composition: Lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer.

Benefit: Small quantities of VALID added before adding pesticides will prevent foam from forming.

Adding VALID to the spray tank will also reduce the production of fine spray droplets that may drift.

Mixing: Mix 125 mL per 100 L of spray mixture.

WATER CONDITIONING AGENTS

See AQUASOFT, CHOICE.

WATER-SOLUBLE DYES

See AQUASHADE.

XA OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal).

Chemical Composition: 83% paraffin-base mineral oil plus 17% surfactant blend.

Registered Uses: Atrazine, ASSURE, BASAGRAN, LADDOCK and other products as labelled.

Benefit: May result in improved postemergence activity.

Mode of Action: Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets, thus improving the penetration through the cuticle of leaf surfaces.

ZAP

Type of Adjuvant: Antifoamer-defoamer.

Chemical Composition: Proprietary blend of ingredients.

Registered Uses: To control foam formation or existing foam. Use as premix or add while spray tank is being filled. For agricultural/industrial uses.

Benefit: The reduction of foam allows for faster tank fill, ensures fill volumes are correct and reduces the possibility of chemical overflow. It also makes the cleaning process easier.

Mixing: Add 2–5 mL/100 L of solution. Adjust the amount required according to individual conditions. May be used before mixing to prevent foam, or after to cut foam. May be used with any herbicide unless contra-indicated on the label. Is particularly effective with glyphosate products, which often foam in solution.

TABLE 5-1. Adjuvants Used in Ontario

Trade Names ^a	Type of Adjuvant	Chemical Composition	Guaranteed Active	Ont. Sch.	Winter Storage	Manufacturer/ Agent Code
AGRAL 90	non-ionic surfactant	nonylphenoxy polyethoxyethanol	90%	3	C	NOR
AG-SURF	non-ionic surfactant	nonylphenoxy polyethoxyethanol	92%	3	C	INT
ALLIANCE	compatibility agent	aliphatic phosphate ester, isopropanol and glycol ethers	69%	N/A	A	NOR
AMIGO	surfactant	phosphate ester	30%	2	C	BCZ
ASSIST OIL CONCENTRATE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	N/A	C	BAZ
AQUASOFT	water conditioning agent	hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid	63%	N/A	A	NOR
AQUA-STABLE	buffering agent	aliphatic polycarboxylate and calcium chloride	28%	N/A	A	NOR
BREAKER	antifoamer/defoamer			N/A	A	UAG
CHOICE	water conditioning agent	polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate	50%	N/A	A	UAG
COMPANION	non-ionic surfactant	ocylphenoxy-polyethoxy-(9) ethanol	70%	4	C	DWE
ENHANCE	non-ionic adjuvant	triglyceride ethoxylate	80%	4	B	NOR
FIGHTER F	antifoamer/defoamer	dimethylpolysiloxane	10%	N/A	A	UAG
FLAT-OUT	antifoamer/defoamer	dimethylpolysiloxane	20%	NA	A	NOR
HALT	defoamer	silicone base, neutral	30%	N/A	A	DWE
HASTEN NT	non-ionic esterified vegetable oil	methyl and ethyl oleate	71.4%	4	B	NOR
IN-SIGHT	foam marker dye	dye, surfactants and coupling agents.	100%	N/A	A	NOR
KORNOIL	mineral oil (non-herbicidal)	mineral oil + emulsifier	98.5% + 1.5%	N/A	C	TEX
KORNOIL CONCENTRATE	mineral oil/surfactant (non-herbicidal)	paraffin base mineral oil + surfactant blend	85% + 15%	N/A	C	TEX
LI700	non-ionic surfactant and pH adjuster acidifier	phosphatidylcholine, methylacetic acid, alky polyoxyethylene ether	80%	4	C	NUA
MERGE	surfactant/solvent	surfactant blend + solvent (petroleum hydrocarbons)	50% + 50%	4	B	BAZ
SIDEKICK II	non-ionic liquid spreader/activator	alkylaryl/polyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	C	NOR
SUPER SPREADER	non-ionic spreader sticker surfactant	ocylphenoxy-polyethoxy ethanol	50%	4	A	UAG
SUPERIOR 70 OIL CONCENTRATE	mineral oil (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	4	A	UAG
SURE-MIX	petroleum oil/ surfactant (non-herbicidal)	paraffinic petroleum oil + surfactant blend	60% + 35.6%	4	A	DUQ
SYLGARD 309	organosilicone, non-ionic	silicone polyether + surfactant blend	76% + 24%	4	B	NOR

^a Mention of a brand or trade name in this table does not constitute a guarantee or warranty of the product by the Ontario Weed Committee. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized.

TABLE 5-1. Adjuvants Used in Ontario (cont'd)

Trade Names ^a	Type of Adjuvant	Chemical Composition	Guaranteed Active	Ont. Sch.	Winter Storage	Manufacturer/ Agent Code
TRAMLINE	foam marker	nonionic and anionic surfactants	35+65%	N/A	A	NOR
TREKKER TRAX	foam marker	alcohols, mixed anionic and nonionic surfactants	54%	N/A	A	UAG
TURBOCHARGE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	50% + 39.5%	4	C	SYN
UNITE	compatibility agent	acid polyglycols and methyl alcohol	83.70%	N/A	A	UAG
VALID	drift retardant/defoamer	lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer	100%	N/A	A	UAG
XA OIL CONCENTRATE	mineral oil/surfactant (non herbicidal)	paraffin base mineral oil + surfactant blend	83% + 17%	4	A	UAG
ZAP	antifoamer/defoamer	proprietary blend	100%	NA	A	NOR

^a Mention of a brand or trade name in this table does not constitute a guarantee or warranty of the product by the Ontario Weed Committee. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized.

TABLE 5-2. Adjuvant Rates Per Sprayer Tank Volume

% Adjuvant / Water	0.1% v/v	0.2% v/v	0.25% v/v	0.5% v/v	1.25% v/v
L Adjuvant / L Water	1 L/1,000 L	2 L/1,000 L	2.5 L/1,000 L	5 L/1,000 L	12.5 L/1,000 L
L Adjuvant / U.S. gal. Water	0.38 L /100 U.S. gal.	0.76 L /100 U.S. gal.	0.95 L /100 U.S. gal.	1.9 L/100 U.S. gal.	4.75 L/100 U.S. gal.

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, on page 23 for a complete list of products.



6. PREPLANT & POSTHARVEST WEED CONTROL

TABLE 6-1. Non-Selective Herbicides Available for Preplant Site Preparation

CROP	AIM EC	AMITROL 240	BASAMID	CLEANSTART PLUS ¹	GRAMOXONE	GUARDIAN ¹	IGNITE	REGLONE	GLYPHOSATE*	VAPAM
Field Crops										
corn	✓	✓		✓	✓			✓	✓	
soybeans	✓	✓		✓	✓	✓		✓	✓	
white beans	✓	✓		✓					✓	
stale seedbed field crops	✓			✓	✓				✓	
tobacco									✓	✓
Vegetables										
field vegetable seedbeds	✓		✓	✓					✓	✓
stale seed beds	✓			✓	✓				✓	
asparagus							✓		✓	
beans	✓			✓				✓	✓	
beets	✓			✓			✓	✓	✓	
carrots	✓			✓			✓	✓	✓	
celery	✓			✓					✓	
cole crops	✓			✓				✓	✓	
corn, sweet	✓			✓				✓	✓	
cucumber	✓			✓				✓	✓	
eggplant	✓		✓	✓					✓	
ginseng									✓	
lettuce	✓		✓	✓			✓		✓	
melons	✓			✓					✓	
onions	✓			✓			✓	✓	✓	
peas	✓			✓				✓	✓	

✓ = Registered for use as a preplant application prior to this crop.

* Numerous products exist; refer to Table 4-1. *Herbicides Used in Ontario*, on page 23 for a complete list of products.

¹ Indicates herbicide sold as a co-pack under this trade name.

TABLE 6-1. Non-Selective Herbicides Available for Preplant Site Preparation (cont'd)

CROP	AIM EC	AMITROL 240	BASAMID	CLEANSTART PLUS ¹	GRAMOXONE	GUARDIAN ¹	IGNITE	REGLONE	GLYPHOSATE*	VAPAM
peppers	✓		✓	✓					✓	
potatoes	✓			✓				✓	✓	
rutabaga	✓			✓				✓	✓	
squash	✓			✓					✓	
tomato	✓		✓	✓					✓	
Fruit Crops										
fruit	✓			✓					✓	✓
berries	✓			✓					✓	
Nursery Stock										
woody nursery stock			✓						✓	✓
herbaceous ornamentals seed and planting beds			✓						✓	
Turfgrass										
turf seedbeds			✓						✓	
turf renovation					✓				✓	

✓ = Registered for use as a preplant application prior to this crop.

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, on page 23 for a complete list of products.

¹ Indicates herbicide sold as a co-pack under this trade name.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 6-2. Preplant Herbicide Weed Control Ratings

Trade Name	Annuals		Perennials														
	annual grasses	annual broadleaves	bindweed, field	chickweed, mouse-eared	dandelion	golden-rod	ground-ivy (creeping charlie)	horsetail	mallow	milkweed	nutsedge	plantains	poison ivy	quackgrass	sow-thistle	thistle, Canada	vetches
Preplant Herbicides																	
AIM EC	0	**	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-
AMITROL 240	**	**	a	-	9	a	-	7	-	a	a	8	8	7	a	7	-
CLEANSTART PLUS ¹	**	**	7a	9	7/8 ²	-	5	0	8	a	7	9	8	8/9	a	a	5
glyphosate*	**	**	7a	9	7/8 ²	-	5	0	5	a	7	9	8	8/9	a	a	5
GRAMOXONE	**	**	b	b	b	-	b	b	b	b	0	b	b	5	b	0	b
GUARDIAN ¹	**	**	7a	9	7/8 ²	-	5	0	5	a	8	9	8	8/9	a	7 ³	5
IGNITE	**	**	8 ⁴	-	8	-	-	7 ⁴	-	6 ⁴	7 ⁴	-	-	8 ⁴	8 ⁴	8 ⁴	-

* Numerous products exist. Refer to Table 4-1, *Herbicides Used in Ontario*, on page 23 for a complete list of products.

** Indicates that most annual weeds will be controlled if emerged.

¹ Indicates herbicide sold as a co-pack under this trade name.

- Insufficient information available to make a rating.

* Optimum growth stages for best control of these weeds will not likely be attained prior to planting in early to mid spring.

² Top growth only, regrowth can be expected.

³ Repeated applications may be necessary.

⁴ Use higher rates for plants over 15 cm tall or across.

TABLE 6-2. Preplant Herbicide Weed Control Ratings (cont'd)

Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations

Glyphosate* Concentration	Product Rate/ac	Weeds Controlled & Notes
360 g/L	0.3–1.4 L/ac	- For control of annual weeds. - Use 50–100 L/ha (20–40 L/ac) for the low rate, or use surfactant with larger water volumes. - The highest rate is required for weeds over 15 cm in height. - For weeds smaller than 15 cm in height consult the product label for weed specific rates. - For actively growing weeds in the fall, or spring prior to emergence of any crop. - Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. - Only weeds emerged at application time will be controlled.
450 g/L	0.24–1.12 L/ac	
480 g/L	0.22–1.05 L/ac	
500 g/L	0.22–1 L/ac	
540 g/L	0.2–0.93 L/ac	
360 g/L	1–2.8 L/ac	- For dandelions and quackgrass. - Apply when quackgrass has 3–4 new leaves. - The low rate will provide a minimum of one season control while higher rates will provide longer term control of quackgrass. - For dandelions, apply the low rate if smaller than 15 cm in diameter and higher rates if greater than 15 cm in diameter.
450 g/L	0.8–2.25 L/ac	
480 g/L	0.75–2.1 L/ac	
500 g/L	0.72–2 L/ac	
540 g/L	0.67–1.87 L/ac	

* Numerous products exist. Refer to Table 4-1. *Herbicides Used in Ontario*, on page 23 for a complete list of products.

** Indicates that most annual weeds will be controlled if emerged.

¹ Indicates herbicide sold as a co-pack under this trade name.

- Insufficient information available to make a rating.

* Optimum growth stages for best control of these weeds will not likely be attained prior to planting in early to mid spring.

² Top growth only, regrowth can be expected.

³ Repeated applications may be necessary.

⁴ Use higher rates for plants over 15 cm tall or across.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

PREPLANT WEED CONTROL

Preplant-Site Preparation Prior To Any Crop

AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	37–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	5–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply to actively growing weed up to 10 cm tall. • Coverage of the weeds is essential for good control. • The preplant tank-mix of AIM EC + glyphosate (CLEANSTART PLUS¹) will provide broader spectrum weed control.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.9–28 g/ha 0.25% v/v 0.1% v/v		
AMITROL 240 (231 g/L) amitrole	4.2–8.4 L/ha 1–2 kg/ha	1.68–3.36 L/ac	• For dandelions and annual weeds. • For corn, soybeans, white beans, wheat, barley, canola and field peas. • Apply in 100–200 L/ha water (40–180 L/ac) 10–14 days before planting the crop. • Wait 10–14 days before tillage and planting (only soybeans may be planted 6 days after application when applied at the low rate). • Use additional herbicide treatments to control weed species that emerge after application. • May be tank-mixed with ROUNDUP or PURSUIT where registered.
AMITROL 240 (231 g/L) amitrole	12.5–16.5 L/ha 3–4 kg/ha	5–6.6 L/ac	• For quackgrass, Canada thistle, sow thistle (fall treatment) and annual weeds. • For use only before white beans, corn and soybeans. • Apply in 100–200 L/ha water (40–180 L/ac). • Apply to actively growing weeds up to 10 cm tall in the fall (until heavy frost) or in spring. • Plow or thoroughly disk 10–14 days after application. • Cultivation may be required when the crop is emerged to improve weed control.
CLEANSTART PLUS ¹ (CREDIT PLUS (360 g/L) + AIM EC (240 g/L)) glyphosate + carfentrazone-ethyl glyphosate*	2.5 L/ha + 73 mL/ha 0.9 + 0.0175 kg/ha Refer to Table 6-2	1.0 L/ac + 30 mL/ac Refer to Table 6-2	• Apply to actively growing weeds, up to 10 cm tall. • Coverage of weed foliage is essential for control. • Only weeds emerged at application will be controlled. • CLEANSTART PLUS¹ provides no residual weed control. • CLEANSTART PLUS¹ is a co-pack of CREDIT PLUS and AIM EC.
glyphosate	0.27–4.32 kg/ha		• For specific information on product rate and notes for annual and perennial weed control, refer to Table 6-2, <i>Preplant Herbicide Weed Control Ratings</i>, page 79.
GRAMOXONE (200 g/L) paraquat	2.75–5.5 L/ha 0.55–1.1 kg/ha	1.1–2.2 L/ac	• Apply to actively growing vegetation at least 3 days prior to crop emergence. • Use the high rate when weeds are above 5 cm in height. • Apply in 300–1,100 L/ha water (120–440 L/ac). • Complete coverage is important. Use higher water volumes on dense vegetation. • Perennial weeds will only be suppressed. • Only emerged weeds will be controlled.

¹ Indicates herbicide sold as a co-pack under this trade name.

* Numerous products exist. Refer to Table 4-1, *Herbicides Used In Ontario*, page 23 for a complete list of products.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
GRAMOXONE (200 g/L)	2.5 L/ha	1 L/ac	• For use as a preplant burndown before no-till corn and soybean.
paraquat	0.5 kg/ha		• Apply to actively growing vegetation at least 3 days prior to crop emergence.
			• Apply in 200–250 L/ha water (80–100 L/ac).
			• Complete coverage is important. Use higher water volume on dense vegetation.
			• Perennial weeds will only be suppressed.
GUARDIAN ¹			• Apply as a preplant burndown to soybeans only .
TOUCHDOWN TOTAL (500 g/L)	1.8 L/ha	0.72 L/ac	• Apply prior to emergence of conventional soybeans.
+ CLASSIC (25 DF)	+ 36 g/ha	+ 14 g/ac	• Some rotational restrictions apply (see CLASSIC label and Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i> , page 61).
glyphosate	0.9 kg/ha		• GUARDIAN is a co-pack of TOUCHDOWN TOTAL + CLASSIC.
+ chlorimuron-ethyl	9 g/ha		
Stale Seedbed and Inter-Row Weeding			
The stale seedbed technique is useful when the soil can be worked well before planting and weeds are allowed to emerge for several weeks. Apply one of the non-selective postemergent herbicides listed here to kill emerged weeds. Seeding or planting directly into the killed weeds with minimal soil disturbance will allow the crop to establish before the next flush of weed emergence. Follow up with either cultivation, hoeing or postemergent or directed herbicides to control later germinating weeds. Where registered, some herbicides can be applied after seeding but before crop emergence.			
AIM EC (240 g/L)	37–117 mL/ha	5–47 mL/ac	• Apply POST with a HOODED SPRAYER between the rows or between the plastic mulch.
plus non-ionic surfactant	2.5 L/1,000 L	2.5 L/1,000 L	• Apply to actively growing weeds up to 10 cm tall.
or MERGE	1 L/1,000 L	1 L/1,000 L	• Apply in a minimum of 100 L/ha (40 L/ac) water.
			• Apply ONLY once per growing season
carfentrazone-ethyl	8.9–28 g/ha		• AIM EC may cause crop injury if the spray is allowed to come in contact with the green stem, leaves, bloom or fruit.
plus non-ionic surfactant	0.25% v/v		• Pre-Harvest Interval (PHI) ranges from 1–15 days depending on the crop. Refer to the product label for a specific crop's PHI.
or surfactant/solvent	0.1% v/v		• Refer to product label or Chapter 4, <i>Notes on Herbicides</i> , page 31 for a list of registered crop uses.
glyphosate*	See Table 6-2	See Table 6-2	• Till and fertilize soil in early spring.
glyphosate	0.27–4.32 kg/ha		• Allow weeds to grow, and spray weeds just before seeding crop.
			• Use low rate for small weeds (8 cm), medium rates for weeds 8–15 cm and higher rate for weeds over 15 cm tall.
GRAMOXONE (200 g/L)	3–5.5 L/ha	1.2–2.2 L/ac	• For emerged weeds after the crop seed is sown, but before crop emergence.
REGLONE (200 g/L)	3–5.5 L/ha	1.2–2.2 L/ac	• For use only in beans (all types), beets, carrots, cole crops, corn, onions, peas, cucumbers, potatoes, soybeans and turnips.
paraquat	0.6–1.1 kg/ha		• In inter-row weeding, special low pressure equipment is used to apply the herbicide on emerged weeds without contact with leaves of the crop plants.
or diquat	0.6–1.1 kg/ha		• For small areas, apply 30 mL product in 10 L water per 100 m ² .
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• For use only in carrot, lettuce and onion crops.
			• Apply in a minimum of 110–330 L/ha (44–132 L/ac) of water.
glufosinate ammonium	0.405–0.75 kg/ha		• Apply after seeding, but prior to emergence of the crop.

¹ Indicates herbicide sold as a co-pack under this trade name.

* Numerous products exist. Refer to Table 4-1, *Herbicides Used in Ontario*, page 23 for a complete list of products.

TABLE 6-3. Postharvest Weed Control Ratings

Crop Stubble	Treatment	Grasses		Perennial Broadleaf Weeds									
		quackgrass	wire stem muhly	bindweed, field	chickweed, mouse-eared	coltsfoot	clover, red	dandelion	hemp dogbane	milkweed	ground cherry	thistle, Canada	sow thistle
Postharvest Herbicides													
glyphosate	glyphosate*	9	9	9	9	8	8	8/9*	8	8	-	9	9
dicamba	BANVEL II, ORACLE	0	0	8	9	7	9	8	8	7	6	8	9
2,4-D	2,4-D*	0	0	7	2	-	5	7	-	0	-	6	7

Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations

Glyphosate* Concentration	Product Rate/ac	Weeds Controlled & Notes
360 g/L	0.3-1.4 L/ac	- For control of annual weeds. - Use 50-100 L/ha (20-40 L/ac) for the low rate, or use surfactant with larger water volumes. - The highest rate is required for weeds over 15 cm in height. - For weeds smaller than 15 cm in height consult the product label for weed specific rates. - For actively growing weeds in the fall, or spring prior to emergence of any crop. - Allow 5-7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. - Only weeds emerged at application time will be controlled.
450 g/L	0.24-1.12 L/ac	
480 g/L	0.22-1.05 L/ac	
500 g/L	0.22-1 L/ac	
540 g/L	0.2-0.93 L/ac	
360 g/L	1-2.8 L/ac	- For dandelions and quackgrass. - Apply when quackgrass has 3-4 new leaves. - The low rate will provide a minimum of one season control while higher rates will provide longer term control of quackgrass. - For dandelions, apply the low rate if smaller than 15 cm in diameter and higher rates if greater than 15 cm in diameter.
450 g/L	0.8-2.25 L/ac	
480 g/L	0.75-2.1 L/ac	
500 g/L	0.72-2 L/ac	
540 g/L	0.67-1.87 L/ac	
360 g/L	2.8-4.8 L/ac	- For perennial broadleaf weeds. Canada thistle and sow thistle should be at least in early bud, milkweed at bud, bindweed at full flower and dogbane past full bloom for best results. - For undisturbed perennials (such as in sod or non-crop areas) use the highest rate and repeat when the plants re-grow to the optimum growth stages mentioned above.
450 g/L	2.25-3.85 L/ac	
480 g/L	2.1-3.6 L/ac	
500 g/L	2-3.5 L/ac	
540 g/L	1.87-3.2 L/ac	

- Insufficient information available to make a rating. * Various products available, see Table 4-1. *Herbicides Used in Ontario*, page 23. * Use higher rates for weeds larger than 15 cm tall or across.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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SPOT TREATMENTS AND POST HARVEST WEED CONTROL

Postharvest (Broadleaf Herbicides)

BANVEL II (480 g/L) or ORACLE (480 g/L)	2.5 L/ha	1 L/ac	- Apply in the fall to actively growing vegetation at least 2 weeks prior to a killing frost. Do NOT apply before fall seeded crops. Only cereals, soybeans, field corn, sweet corn or white beans may be grown year after application.
<i>dicamba</i>	1.2 kg/ha		
2,4-D ESTER 600* (564 g/L) or 2,4-D ESTER 700* (660 g/L)	1.5–2.9 L/ha 1.29–2.5 L/ha	0.6–1.16 L/ac 0.52–1.0 L/ac	- Apply in the fall at the time of rapid growth. - Use the higher rate for legumes and perennial weeds. - For best results apply to actively growing vegetation at least 2 weeks before a killing frost. Do NOT apply before fall wheat or barley.
2,4-D	0.85–1.655 kg/ha		

Postharvest (Grass and Broadleaf Herbicides)

AMITROL 240 (231 g/L)	12.5–16.5 L/ha	5–6.6 L/ac	- Apply after harvest when regrowth is 10–15 cm tall for Canada thistle and sow-thistle. Do NOT cultivate for 2 weeks after application. Do NOT apply after a heavy frost, generally after October 1. Do NOT plant to a crop for 8 months after treatment.
<i>amitrole</i>	3–4 kg/ha		
BANVEL II (480 g/L) or ORACLE (480 g/L) plus glyphosate* plus non-ionic surfactant	1.25 L/ha See Precautions 0.35 L/ha	0.5 L/ac See Precautions 0.14 L/ac	- Apply to actively growing vegetation at least 2 weeks prior to a killing frost. For the control of red clover, volunteer cereals and annual broadleaf weeds. Do NOT apply before fall seeded crops.
<i>dicamba</i> plus glyphosate plus non-ionic surfactant	0.6 kg/ha 0.6 kg/ha 0.35 L/ha		Glyphosate Product Rate Equivalent to 0.6 kg/ha active ingredient: - Glyphosate (360 g/L): 1.7 L/ha (0.68 L/ac) - Glyphosate (450 g/L): 1.33 L/ha (0.53 L/ac) - Glyphosate (480 g/L): 1.25 L/ha (0.5 L/ac) - Glyphosate (500 g/L): 1.2 L/ha (0.48 L/ac) - Glyphosate (540 g/L): 1.11 L/ha (0.44 L/ac)
glyphosate*	See Table 6-2	See Table 6-2	For specific information on product rate and notes for annual and perennial weed control, refer to Table 6-2. <i>Preplant Herbicide Weed Control Ratings</i>, page 79.
<i>glyphosate</i>	0.27–4.32 kg/ha		

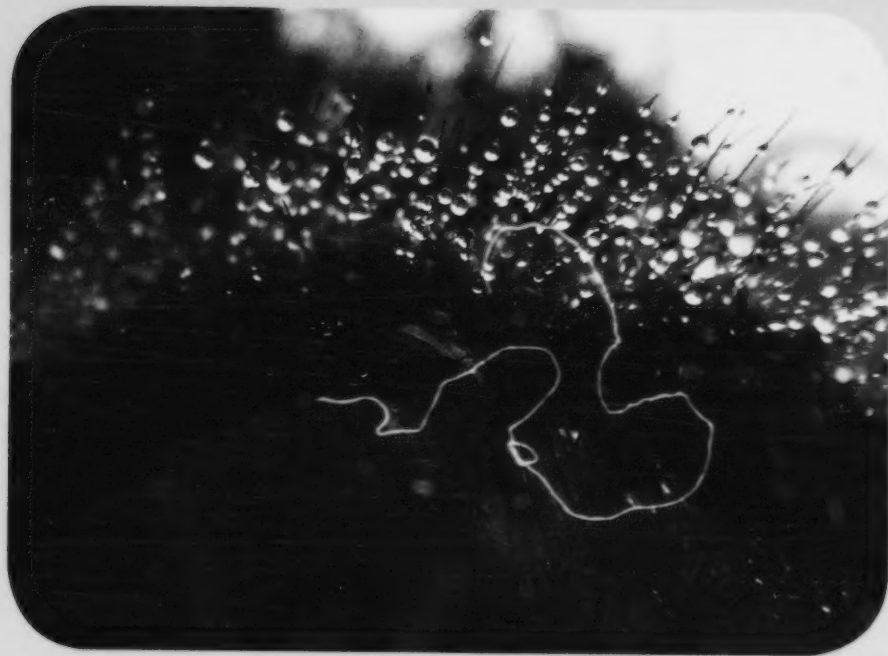
Spot Treatments with Hand-Held Equipment

AMITROL 240 (231 g/L)	12.5–16.5 L/ha	5–6.6 L/ac	- Use only for non-crop land and pasture. - Thoroughly wet all leaves and stems of weeds. Repeat applications when new growth appears. - Apply to Canada thistle and sow-thistle at early bud to bloom, quackgrass and horsetail at 10–15 cm, dandelion when young, toadflax and hoary cress at advanced rosette, milkweed in early summer, poison ivy when fully leafed. Do NOT allow livestock to eat treated vegetation. Keep livestock off treated area until weeds are dead and new growth has emerged.
<i>amitrole</i>	3–4 kg/ha		

* Numerous products exist. Refer to Table 4-1. *Herbicides Used in Ontario*, page 23 for a complete list of products.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69)
glyphosate (360 g/L)	1 L-2 L/100 L		- For actively growing weeds. Direct spray to avoid desirable vegetation. - Allow 5-7 days translocation time after application before doing any mowing or tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. - Canada thistle and sow-thistle should be at least in early bud, milkweed at bud, bindweed at full flower, and dogbane past full bloom, and quackgrass with 3-4 new leaves for best results.
or glyphosate (450 g/L)	0.8-1.6 L/100L		
or glyphosate (480 g/L)	0.75-1.5 L/100 L		
or glyphosate (500 g/L)	0.72-1.44 L/100 L		
or glyphosate (540 g/L)	0.67-1.34 L/100 L		
glyphosate*	0.36-0.72 kg/100 L		
Wick Wiper and Roller Application			
glyphosate (360 g/L)	1 L/2 L water		- Wick wiper applications for use on soybeans, white beans, apple, cherry, peach, pear, plum, grape, strawberries and cranberries. - Apply to weeds that extend above the crop sufficiently to allow good contact with the application equipment. Do NOT contact the crop with the equipment or allow the chemical solution to drip from the applicator on to the crop. - A 33% herbicide mixture (1 L/2 L of water) provides good control of most weeds.
or glyphosate (450 g/L)	0.8 L/2 L water		
or glyphosate (480 g/L)	0.75 L/2 L water		
or glyphosate (500 g/L)	0.72 L/2 L water		
or glyphosate (540 g/L)	0.67 L/2 L water		
glyphosate*	0.36 kg/2 L water		

* Numerous products exist. Refer to Table 4-1, *Herbicides Used in Ontario*, page 23 for a complete list of products.



7. BEANS (ADZUKI, DRY, LIMA & SNAP)

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 7-1. Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings

Trade Name	Crop Registrations											Annual Grasses							Annual Broadleaves										Perennials							Crop Tolerance			
	adzuki beans	black beans	dutch brown	cranberry beans	kidney beans	lima beans	otebo beans	pinto beans	small red Mexican	snap beans	yellow eye	white beans	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass		sow-thistle	thistle, Canada	
Preplant Incorporated Grass Herbicides																																							
DUAL II MAGNUM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	9	8 ^a	8	9	9	9	4	2	0	2	7	2	8 ^c	7	4	3	2	0	0	0	8 ^b	0	0	0	G	
EPTAM	✓	✓	✓	✓				✓		✓	✓	✓	9	9	8	9	9	9	9	7	4	0	7	7	5	7	7	5	3	5	-	-	-	8	5	-	-	E	
FRONTIER					✓							✓	9	9	8 ^a	8	9	9	9	4	2	0	2	7	2	8 ^c	7	4	3	2	0	0	0	8 ^b	0	0	0	G	
RIVAL, TREFLAN or BONANZA	✓				✓	✓				✓		✓	9	9	9	9	9	9	9	7	5	0	2	8	2	2	8	2	1	2	2	2	2	2	2	2	2	E	
Preplant Incorporated Grass and Broadleaf Herbicides																																							
PURSUIT	✓			✓	✓							✓	8	7	7	9	9	9	8	7	8	2	9	9	9	9	9	8	6	9	2	2	2	7	6	2	2	G	
Preplant Incorporated Tank-Mixes																																							
DUAL II MAGNUM + PURSUIT				✓	✓								9	9	8 ^a	9	9	9	9	7	8	2	9	9	9	9	9	8	6	9	-	-	-	8	7	-	-	E	
EPTAM + RIVAL, TREFLAN or BONANZA					✓							✓	9	9	9	9	9	9	9	7	5	5	7	8	5	8	8	5	3	5	-	-	-	8	7	-	-	E	
FRONTIER MAX + PURSUIT	✓	✓	✓	✓			✓	✓	✓		✓	✓	9	9	8 ^a	9	9	9	9	7	8	2	9	9	9	9	9	8	6	9	-	-	-	8	7	-	-	E	
RIVAL, TREFLAN or BONANZA + PURSUIT												✓	9	9	9	9	9	9	9	7	8	5	9	9	9	9	9	8	6	9	2	2	2	7	6	2	2	G	

Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

† POAST ULTRA (quackgrass rate – 1.1 L/ha) is not registered for use on snap beans.

^a Use the high rate of herbicide for optimum control.

^b Use PPI timing for optimum control.

^c Use PRE timing for optimum control.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

TABLE 7-1. Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings (cont'd)

Trade Name	Crop Registrations											Annual Grasses										Annual Broadleaves										Perennials										Crop Tolerance
	adzuki beans	black beans	dutch brown	cranberry beans	kidney beans	lima beans	otebo beans	pinto beans	small red Mexican	snap beans	yellow eye	white beans	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada					
Preemergence Grass Herbicides																																										
DUAL II MAGNUM	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	9	9	8 ^a	8	9	9	9	4		2	0	2	7	2	8 ^c	7	4	3	2	0	0	0	7	0	0	0	G				
FRONTIER MAX	✓	✓	✓	✓		✓	✓	✓		✓	✓	9	9	8 ^a	8	9	9	9	4		2	0	2	7	2	8 ^c	7	4	3	2	0	0	0	7	0	0	0	G				
Preemergence Grass and Broadleaf Herbicides																																										
PURSUIT	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	8	7	7	9	9	9	8	7	8	2	9	9	9	9	9	8	6	9	2	2	2	7	6	2	2	G				
Preemergence Tank-Mixes																																										
DUAL II MAGNUM + PURSUIT				✓	✓							9	9	8 ^a	9	9	9	9	7	8	2	9	9	9	9	9	8	6	9	-	-	-	8	7	-	-	E					
FRONTIER MAX + PURSUIT	✓	✓	✓	✓		✓	✓	✓		✓	✓	9	9	8 ^a	9	9	9	9	7	8	2	9	9	9	9	9	8	6	9	-	-	-	8	7	-	-	E					
Postemergence Grass Herbicides																																										
ASSURE II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	8	9	9	9	8	9	9		0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	E				
EXCEL SUPER		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	8	9	9	9	8	9	9		0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	E				
POAST ULTRA ¹	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ ¹	✓	9	8	9	9	9	9	9	9		0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	E				
SELECT	✓							✓			✓	9	8	9	9	9	9	9	9		0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	E					
Postemergence Broadleaf Herbicides																																										
BASAGRAN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	0		7	5	9	7	9	7	7	8	6	9	6	2	2	8	0	5	7	G				
BASAGRAN FORTÉ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	0		7	5	9	7	9	7	7	8	6	9	6	2	2	8	0	5	7	G				
REFLEX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	0		8	2	8	6	9	8	9	9	7	6	3	6	2	-	0	5	3	F				
Postemergence Tank-Mixes																																										
EXCEL SUPER + BASAGRAN				✓			✓				✓	9	8	9	9	9	8	9	9		7	5	9	7	9	7	7	8	6	9	5	2	2	8	1	5	7	G				
BASAGRAN + REFLEX				✓							✓	0	0	0	0	0	0	0	0		8	5	9	7	9	8	9	9	7	9	5	2	2	8	1	5	7	F				

Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor.

BOLD numbers indicate the weed is listed on the product label for control or suppression.* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.¹ POAST ULTRA (quackgrass rate – 1.1 L/ha) is not registered for use on snap beans.^a Use the high rate of herbicide for optimum control.^b Use PPI timing for optimum control.^c Use PRE timing for optimum control.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

Beans (Adzuki, Dry, Lima and Snap)

Dry beans include black, cranberry, Dutch brown, kidney, mung, otebo, pinto, small red Mexican, yellow eye and white bean market classes.

Apply all treatments in 150–300 L/ha (60–120 L/ac) water unless otherwise specified.

When developing a weed control program, consider cultivation, rotation and other cultural practices along with herbicide treatments. Any single method of weed control, or the continuous use of the same chemical, can lead to the build up of weeds resistant or tolerant to that control method. Rotating crops and/or other control methods reduce the chance of developing new or unique weed infestations.

High speed (10–20 km/hr), shallow (2.5–3 cm) cultivation with a rotary hoe when beans are in the 1–2 leaf stage helps control small weed seedlings. This technique does not reduce herbicide action and may, in some years, enhance chemical weed control and improve crop safety.

Inter-row cultivation may be needed when weeds escape herbicide treatment; consider weeds 'escapes'

when they are 5–7 cm high. Cultivate shallow to prevent exposure of untreated soil and germination of new weed seeds.

Band treatment of chemical over the row reduces costs by one-half to two-thirds, depending on row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation will give some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another.

Some chemicals may also be impregnated on dry bulk fertilizer. Check the label for recommended fertilizer ingredients. Please refer to Table 7-1. *Beans (Dry, Lima and Snap) Herbicide Weed Control Ratings*, page 87 to determine which market classes of edible beans are registered for the herbicide treatments listed.

Rates and application techniques vary for trifluralin products. For further information on these and other chemicals refer to label recommendations and also *Notes on Herbicides*, on page 31.

Herbicide Application Timings

- **Preplant (PP)** – Also see *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, on page 81 for details of products, rates and remarks.

- **Preplant Incorporated (PPI)** – Unless stated otherwise, two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Pay special attention to machinery cleanliness and/or treating fields with perennial weeds last.
- **Preemergence (PRE)** – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.
- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see <i>Notes on Herbicides</i> , page 31).
Soil Applied Grass Herbicides			
DUAL II MAGNUM (915 g/L)	1.15–1.75 L/ha	0.46–0.7 L/ac	• Apply PPI or PRE on all dry bean (<i>Phaseolus vulgaris</i>) species, except Lima when applied PRE. • Apply PPI to minimize the potential for crop injury. • Do NOT use on adzuki beans. • Do NOT use on muck, peat or high organic matter soils. • Use the low rate on coarse-textured soils low in organic matter. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • Improved control of yellow nutsedge is obtained when DUAL MAGNUM is applied PPI. • Use the higher rate for the control of nightshade.
s-metolachlor/benoxacor	1.05–1.6 kg/ha		
EPTAM (800 g/L)	4.25–5.5 L/ha	1.7–2.2 L/ac	• Apply PPI. Incorporate immediately. • Do NOT use on adzuki, lima, otebo and small red Mexican beans. • If dry weather has preceded the application of EPTC, delay seeding 7–10 days. • Temporary injury can occur in the emerging crop. • Use the high rate for nutsedge control.
EPTC	3.4–4.4 kg/ha		
FRONTIER MAX (720 g/L)	763–963 mL/ha	302–385 mL/ac	• Apply PPI or PRE. • Apply PPI to minimize the potential for crop injury. • Do NOT use on adzuki, snap or lima beans. • Do NOT use on muck, peat or high organic matter soils. • Use the low rate on coarse-textured soils low in organic matter. • Minimum PPI rate is 860 mL/ha (344 mL/ac). • Improved control of yellow nutsedge is obtained when FRONTIER MAX is applied PPI. • Use the higher rate of FRONTIER MAX for the control of nightshade and pigweed. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • If using FRONTIER (900 g/L) PRE, apply at rates of 1.1–1.4 L/ha (0.44–0.56 L/ac) and PPI at 1.4 L/ha (0.56 L/ac)
dimethenamid	544–693 g/ha		
TREFLAN EC (480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac	• Apply PPI. Incorporate as soon as possible. Within 24 hours. • Do NOT use on adzuki, brown, cranberry, otebo, pinto, small red Mexican and yellow-eye beans. • Do NOT exceed 1.2 L/ha (0.48 L/ac) of TREFLAN on medium textured soils and 1.7 L/ha (0.68 L/ac) in heavy textured soils for lima beans.
or RIVAL (500 g/L)	1.2–2.3 L/ha	0.48–0.92 L/ac	
or BONANZA 400 (400g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
trifluralin	0.6–1.155 kg/ha		
Soil Applied Grass and Broadleaf Herbicides			
PURSUIT (240 g/L)	0.312 L/ha	0.125 L/ac	• Apply PPI on adzuki, cranberry, kidney and white beans. • Apply PRE on adzuki, black, brown, cranberry, kidney, lima, otebo, small red Mexican, snap, yellow eye and white beans. • Do NOT apply on pinto beans. • Delayed maturity or stunting may occur if cold and/or wet conditions are experienced within first week after application. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • Delayed maturity may result from the application of PURSUIT. • Do NOT harvest within 100 days of application. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
imazethapyr	0.075 kg/ha		

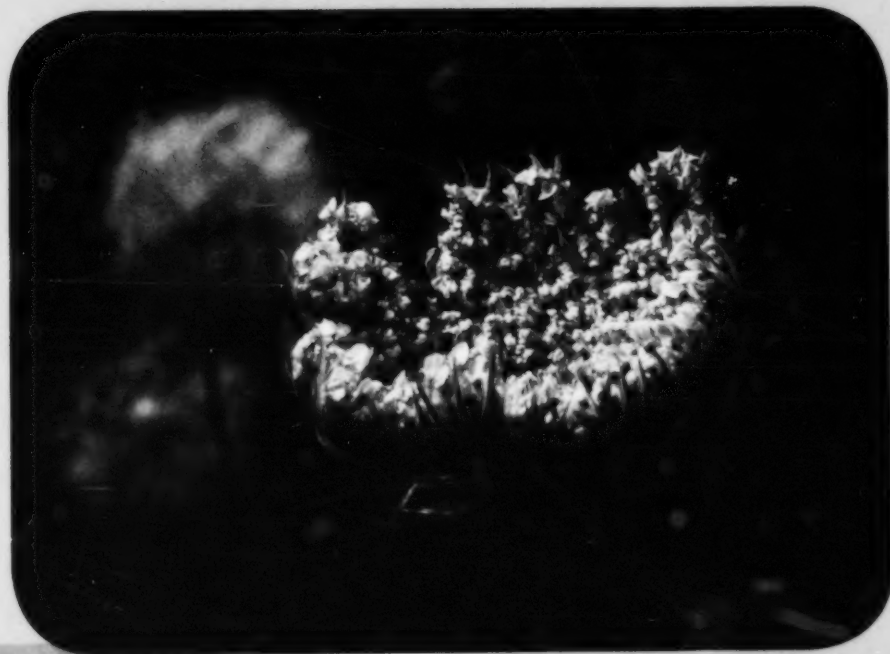
TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see <i>Notes on Herbicides</i> , page 31).
Soil Applied Tank-Mixes			
DUAL II MAGNUM (915 EC) plus PURSUIT (240 g/L)	1.15–1.75 L/ha 0.312 L/ha	0.46–0.7 L/ac 0.125 L/ac	• Apply PPI or PRE, for use ONLY on cranberry or kidney beans. • Apply PPI to minimize the potential for crop injury. • Do NOT use on muck, peat or high organic matter soils. • Use the low rate on coarse-textured soils low in organic matter. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • Do NOT harvest within 100 days of application. • Some rotational cropping restrictions apply (see Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
s-metolachlor/benoxacor plus imazethapyr	1.05–1.60 kg/ha 0.075 kg/ha		
EPTAM (800 g/L) plus TREFLAN EC (480 g/L) or RIVAL (500 g/L) or BONANZA 400 (400 g/L)	3 L/ha 1.25 L/ha 1.2 L/ha 1.5 L/ha	1.2 L/ac 0.5 L/ac 0.48 L/ac 0.6 L/ac	
EPTC plus trifluralin	2.4 kg/ha 0.6 kg/ha		
FRONTIER MAX (720 g/L) plus PURSUIT (240 g/L)	0.756–0.963 L/ha 0.312 L/ha	0.302–0.385 L/ac 0.125 L/ac	
dimethenamid-P plus imazethapyr	0.544–0.693 kg/ha 0.075 kg/ha		• Apply PPI or PRE. • Apply PPI to minimize the potential for crop injury. • Minimum PPI rate is 860 mL/ha (344 mL/ac). • Do NOT use on adzuki, snap or lima beans. • Use the low rate on coarse-textured soils low in organic matter. • Do NOT harvest within 100 days of application.
PURSUIT (240 g/L) plus TREFLAN EC (480 g/L) or RIVAL (500 g/L) or BONANZA 400 (400 g/L)	0.312 L/ha 1.25–2.4 L/ha 1.2–2.3 L/ha 1.5–2.75 L/ha	0.125 L/ac 0.5–0.96 L/ac 0.48–0.92 L/ac 0.6–1.1 L/ac	• Apply PPI and incorporate as soon as possible. Incorporate within 24 hours. • Use only on white beans. • Some rotational cropping restrictions apply (see Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
imazethapyr	0.075 kg/ha		
plus trifluralin	0.6–1.15 kg/ha		
Postemergence Grass Herbicides			
ASSURE II (96 g/L) plus SURE-MIX	0.38–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac 5 L/1,000 L	• Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and volunteer corn and quackgrass in the 2–6 leaf stage. • For use on all market classes of edible beans listed in Table 7-1. <i>Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings</i>, plus mung beans. • Use the 0.38 L/ha (0.15 L/ac) rate of ASSURE II for control of volunteer corn, volunteer cereals and green foxtail. • The 0.5 L/ha (0.2 L/ac) rate of ASSURE II will suppress quackgrass and also control barnyard grass. • Use the 0.75 L/ha (0.3 L/ac) rate of ASSURE II for control of quackgrass.
quizalofop-p-ethyl plus oil concentrate	0.036–0.07 kg/ha 0.5% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Notes on Herbicides, page 31).
EXCEL SUPER (80.5 g/L) fenoxaprop-p-ethyl	0.67 L/ha 0.054 kg/ha	0.27 L/ac	• Apply POST when annual grasses are in the 2–5 leaf stage. • Apply POST to all dry bean (<i>Phaseolus vulgaris</i>) species listed in Table 7-1. <i>Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings</i>, page 87. • Do NOT use on adzuki beans. • Do NOT apply if rain is expected within 1 hour after application.
POAST ULTRA (450 g/L) plus MERGE sethoxydim plus surfactant	0.32–1.1 L/ha 1–2 L/ha 0.15–0.5 kg/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply POST when annual grasses and volunteer cereals are in the 1–6 leaf stage and quackgrass is in the 1–3 leaf stage. • Apply POST to Adzuki and all dry bean (<i>Phaseolus vulgaris</i>) species listed in Table 7-1. <i>Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings</i>, page 87. • Maximum rate on snap beans is 0.65 L/ha (0.26 L/ac). • Use the intermediate rate (0.47 L/ha) for volunteer spring cereals. • Use the high rate (1.1 L/ha) for quackgrass. • Thorough preplant tillage will ensure more uniform quackgrass emergence. Follow with a cultivation 7 days after treatment in wide row crops. • Do NOT apply if rain is expected within 1 hour after application.
SELECT (240 g/L) plus AMIGO clethodim plus surfactant	0.125–0.19 L/ha 5 L/1,000 L 0.03–0.046 kg/ha 0.5% v/v	0.05–0.076 L/ac	• Apply POST when annual grasses and volunteer cereals are in the 1–6 leaf stage. • Do NOT apply if rain is expected within 1 hour after application. • Do NOT use on adzuki, dutch brown, cranberry, kidney, lima, otebo, small red Mexican, snap and yellow eye beans.
Postemergence Broadleaf Herbicides			
BASAGRAN FORTÉ (480 g/L) or BASAGRAN (480 g/L) plus ASSIST bentazon plus oil concentrate	1.75–2.25 L/ha 1.75–2.25 L/ha 2 L/ha 0.84–1.08 kg/ha 2 L/ha	0.7–0.9 L/ac 0.7–0.9 L/ac 0.8 L/ac	• Apply POST when beans are in the unifoliate to 4 trifoliate leaf stage. • Apply POST to all dry bean (<i>Phaseolus vulgaris</i>) species listed in Table 7-1. <i>Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings</i>, page 87. • Do NOT use on adzuki beans. • Apply when weeds are small and actively growing. • Two applications of 1.75 L/ha (0.7 L/ac) 10 days apart may be required to control the perennial weeds. • No adjuvant is required with BASAGRAN FORTÉ. • Do NOT apply if rain is expected within 6 hours after application.
REFLEX (240 g/L) plus AGRAL 90 fomesafen plus adjuvant	1 L/ha 2.5 L/1,000 L 0.24 kg/ha 0.25% v/v	0.4 L/ac 2.5 L/1,000 L	• Do NOT use on adzuki beans. • Apply POST when beans are in the 1–2 trifoliate leaf stage. • Apply when weeds are small and actively growing. • Apply in 200–350 L water/ha (80–140 L/ac water). • Do NOT apply if rain is expected within 4 hours after application. • Do NOT apply REFLEX to any field more often than once every 2 years. • Do NOT apply to crop under stress. • Some rotational cropping restrictions apply. • Do NOT harvest dry beans within 84 days of application. • Do NOT harvest snap beans within 30 days of application.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see <i>Notes on Herbicides</i> , page 31).
Postemergence Tank-Mixes			
BASAGRAN (480 g/L) plus REFLEX (240 g/L) plus ASSIST	1.75 L/ha 0.58 L/ha 2 L/ha	0.7 L/ac 0.23 L/ac 0.8 L/ac	• Apply POST when beans are in the 1–2 trifoliate leaf stage. • Use only on white and kidney beans. • Refer to the BASAGRAN label and the REFLEX label for information on specific weed stage and height. • Do NOT apply if rain is expected within 6 hours after application.
bentazon plus fomesafen plus oil concentrate	0.84 kg/ha 0.14 kg/ha 2 L/ha		
EXCEL SUPER (80.5 g/L) plus BASAGRAN (480 g/L) plus ASSIST	0.67 L/ha 1.75–2.25 L/ha 2 L/ha	0.27 L/ac 0.7–0.9 L/ac 0.8 L/ac	• Apply POST when beans are in the unifoliate to 4 trifoliate leaf stage and annual grasses are in the 2–5 leaf stage. • Apply POST to all dry bean (<i>Phaseolus vulgaris</i>) species listed in Table 7-1. <i>Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings</i>, page 87. • Do NOT use on adzuki beans. • Temporary crop injury may occur under abnormally hot, humid conditions. Reduce the oil concentrate to 1 L/ha (0.4 L/ac) when these conditions occur. Apply when weeds are small and actively growing. • Refer to the BASAGRAN label for information on specific weed stage and height. • If broadleaf and grass weeds are not in the correct leaf stage for a tank-mix application, use a split application at the correct stage for each product. • Do NOT apply if rain is expected within 6 hours after application.
fenoxaprop-p-ethyl plus bentazon plus oil concentrate	0.054 kg/ha 0.84–1.08 kg/ha 2 L/ha		
Preharvest			
AIM EC (240 g/L) plus non-ionic surfactant or MERGE	73–117 mL/ha 2.5 L/1,000 L 10 L/1,000 L	30–47 mL/ac 2.5 L/1,000 L 10 L/1,000 L	• Apply to actively growing weeds, up to 10 cm. • Coverage of weed and crop foliage is essential for control. • Preharvest interval (PHI) is 1 day.
carfentrazone-ethyl plus non-ionic surfactant or MERGE	0.0175–0.028 kg/ha 0.25% v/v 0.1% V/V		
glyphosate (360 g/L) or glyphosate (450 g/L) or glyphosate (480 g/L) or glyphosate (500 g/L) or glyphosate (540 g/L)	2.5 L/ha 2 L/ha 1.88 L/ha 1.8 L/ha 1.67 L/ha	1 L/ac 0.8 L/ac 0.75 L/ac 0.72 L/ac 0.67 L/ac	• Apply Preharvest when the crop is 30% grain moisture or less (yellow to brown pod colour, 80–90% leaf drop) and at least 7 days prior to harvest. • Do NOT use on snap beans. • Do NOT apply to crops grown for seed. • Do NOT apply by air. • Apply in 50–100 L/ha of water. • Do NOT apply if rain is expected within 6 hours after application.
glyphosate*	0.9 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see <i>Notes on Herbicides</i> , page 31).
IGNITE (150 g/L) glufosinate ammonium	2.5–3 L/ha 0.37–0.45 kg/ha	1–1.2 L/ac	• Apply Preharvest when approximately 50–75% of the bean pods have naturally changed colour from green to yellow or brown and at least 9 days before harvest. • Do NOT use on snap beans. • Do NOT apply to dry beans grown for seed. • Use the higher rate when the crop canopy is dense and/or there are high populations of weeds present at application. • Apply in a minimum of 110 L/ha (44 L/ac) of water at a pressure of 275 kPa (40 psi). Where crop canopy is dense, or weed growth is heavy, apply 170–220 L/ha (68–88 L/ac) of water. • Do NOT apply by air. • Do NOT apply if rain is expected within 4 hours after application.
REGLONE DESICCANT (240 g/L) plus AGRAL 90 or AG-SURF diquat plus surfactant	1.25–2.3 L/ha 1 L/1,000 L 0.3–0.55 kg/ha 0.1% v/v	0.5–0.92 L/ac 1 L/1,000 L	• Apply Preharvest when 80% natural leaf defoliation and 80% of the pods have turned yellow. • Do NOT use on lima or snap beans. • Avoid regrowth by targeting spray within 7 days of bean variety maturity date and harvest 5–7 days after application. • Use 1.25–1.7 L/ha by ground and 1.7–2.3 L/ha for aerial applications. • Use a minimum of 225 L/ha of spray volume. • Use the higher rate for heavy canopy of crop or weeds. • Do NOT apply if rain is expected within 15 minutes after application.



8. CEREAL CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 8-1. Weed Control Ratings and Registered Tank-mix partners for Grass Herbicides in Cereals

	Crop Registrations										Annual and Perennial Grasses										Tank-mix Partners for Broadleaf Weed Control								
Trade Name	oats	spring barley	spring wheat	winter barley	fall rye	fall wheat	alfalfa (underseeded)	red clover (underseeded)	trefoil (underseeded)	forage grasses (underseeded)	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	quackgrass	wild oats	BUCTRIL M , BADGE	BROTEX	INFINITY	KORIL	LOGIC M	MEXTROL	PARDNER	Crop Tolerance	
Soil Applied Grass Herbicides																													
TREFLAN, RIVAL or BONANZA					✓	✓					9	9	9	9	9	9	9	7	2	8									F
Postemergence Grass Herbicides																													
ACHIEVE LIQUID	✓	✓				✓	✓	✓	✓		8	-	-	-	9	9	-	-	0	9	Pg 102	Pg 102	Pg 103	Pg 102	Pg 102	Pg 102	Pg 102		G
PUMA ¹²⁰ SUPER or PUMA ADVANCE		✓									9	-	-	-	9	9	-	-	0	9	Pg 103					Pg 103	Pg 103		G

BOLD numbers indicate the weed is listed on the product label for control or suppression.

* Various formulations available, see Table 4-1, *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

¹ Indicates product sold as a co-pack.

Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor.

- Insufficient information available to make a rating.

✓ Can be used on this crop.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 8-2. Cereal Herbicide Weed Control Ratings

	Crop Registrations										Annual Broadleaf Weeds																		Perennial Weeds															
Trade Name	oats	spring barley	spring wheat	winter barley	fall rye	fall wheat	alfalfa (underseeded)	red clover (underseeded)	trefoil (underseeded)	forage grasses (underseeded)	atriplex, spreading	buckwheat, wild	canola, volunteer	cocklebur	chamomile, scentless	chickweed, common	cleavers	corn spurry	fleabane, Canada	henbane	lady's-thumb	lamb's-quarters	lettuce, prickly	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	shepherd's purse	stinkweed	velvetleaf	violet, field	bindweed, field	carrot, wild	chickweed, mouse-eared	curled dock	dandelion	ground-ivy (creeping-charlie)	horsetail	sow-thistle	thistle, Canada	vetches	Crop Tolerance	
Soil Applied Broadleaf Herbicides																																												
TREFLAN, RIVAL or BONANZA		✓	✓	✓							-	5	0	2	-	-	-	-	0	5	2	8	-	2	2	8	2	1	-	-	2	-	2	-	2	-	0	0	-	2	2	2	-	F
Postemergence Broadleaf Herbicides																																												
2,4-D*		✓	✓		✓	✓					7	4	8	8	-	2	2	2	8	2	4	9	9	9	7	9	8	-	9	9	8	-		7	1	-	7	6	-	2	5	8	0	F
BANVEL II or ORACLE		✓	✓	✓		✓			✓		-	9	-	9	-	8	7	9	8	7	9	9	5	7	9	9	9	-	6	6	9	-		8	1	-	9	6	-	0	8	8	5	P
BUCTRIL M, BADGE, MEXTROL or LOGIC M		✓	✓	✓		✓	✓		✓	✓	6	9	9	8	5	2	4	2	7	7	9	9	8	9	9	8	9	-	9	9	9	5		7	1	-	-	6	-	7	7	7	-	E
DYVEL		✓	✓	✓	✓	✓					-	9	-	-	-	-	8	9	8	8	9	9	9	9	-	9	9	-	9	9	-	-		8	-	-	-	-	-	8	8	-	P	
EMBUTOX, CALIBER or COBUTOX		✓	✓	✓	✓	✓	✓	✓	✓	✓	-	6	7	9	-	2	-	2	-	2	4	9	-	7	7	9	8	-	8	6	8	-		-	-	2	6	5	-	2	5	-	2	G
ESTAPROP PLUS, DICHLORPROP-D or TURBOPROP			✓	✓		✓					8	8	9	-	6	2	3	2	8	7	8	9	9	9	-	9	9	-	9	9	-	6		7	3	-	-	9	-	2	8	8	6	G
INFINITY		✓	✓			✓					9	9	9	-	-	9	8	-	8	9	-	9	8	9	-	9	9	9	9	9	-	5		-	2	-	-	7	-	-	8	7	5	E
LONTREL		✓	✓								3	8	0	5	8	2	-	-	-	-	5	2	-	2	2	2	7	-	-	-	-	-		-	-	-	9	-	-	9	9	9	F	
MCPA*		✓	✓	✓		✓	✓				-	2	9	7	-	2	3	7	7	8	2	9	9	9	-	9	9	-	9	9	8	-		7	1	-	-	6	-	8	7	7	5	F
MCPA SODIUM		✓	✓	✓		✓	✓	✓			-	2	9	7	-	2	-	7	7	8	2	9	-	9	-	9	8	-	9	9	8	-		-	-	-	-	-	-	-	-	-	-	G
MECOPROP or COMPITOX		✓	✓	✓	✓	✓					-	2	-	-	-	9	-	9	-	2	2	9	-	9	-	9	9	-	-	7	-	-		-	-	9	-	-	-	-	-	7	5	G
PARDNER, BROTEX or KORIL		✓	✓	✓		✓	✓				-	8	7	8	-	2	-	2	-	2	8	9	-	7	9	7	9	-	8	8	9	-		5	-	-	-	-	-	0	6	5	-	E

BOLD numbers indicate the weed is listed on the product label for control or suppression.

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

¹ Indicates product sold as a co-pack.

Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor.

- Insufficient information available to make a rating.

✓ Can be used on this crop.

TABLE 8-2. Cereal Herbicide Weed Control Ratings (cont'd)

	Crop Registrations									Annual Broadleaf Weeds																	Perennial Weeds																
Trade Name	oats	spring barley	spring wheat	winter barley	fall rye	fall wheat	alfalfa (underseeded)	red clover (underseeded)	trefoil (underseeded)	forage grasses (underseeded)	atriplex, spreading	buckwheat, wild	canola, volunteer	cocklebur	chamomile, scentless	chickweed, common	cleavers	corn spurry	fleabane, Canada	henbane	lady's-thumb	lamb's-quarters	lettuce, prickly	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	shepherd's purse	stinkweed	velvetleaf	violet, field	bindweed, field	carrot, wild	chickweed, mouse-eared	curled dock	dandelion	ground-ivy (creeping-charlie)	horsetail	sow-thistle	thistle, Canada	vetches	Crop Tolerance
REFINE SG	✓	✓	✓			✓					-	9	9	-	7	9	6	9	4	9	9	9	8	8	-	9	2	-	9	9	8	7	2	8	-	-	5	-	-	8	8	-	E
TARGET, TRACKER XP <u>or</u> SWORD	✓	✓	✓	✓		✓					-	9	9	-	-	2	8	9	8	8	8	9	9	9	-	9	9	-	9	9	-	-	8	5	-	-	6	-	-	8	8	-	P
TROPHY ¹						✓					8	7	9	9	-	-	9	-	-	8	7	9	8	9	-	9	9	-	9	9	-	8	-	-	-	-	9	-	8	8	7	G	
TROPOTOX PLUS, CLOVITOX PLUS <u>or</u> TOPSIDE	✓	✓	✓	✓	✓	✓		✓	✓		-	7	9	-	-	2	-	2	-	8	2	9		9	-	9	8	-	9	9	9	-	8	-	-	-	-	-	-	9	9	5	G
Postemergence Broadleaf Herbicide Tank-Mixes																																											
BUCTRIL M, BADGE, LOGIC M <u>or</u> MEXTROL + MCPA*		✓	✓			✓	✓				6	9	9	8	7	2	4	2	7	7	9	9	9	9	9	9	9	-	9	9	9	5	7	1	-	7	6	-	7	7	8	-	F
EMBUTOX, CALIBER <u>or</u> COBUTOX + MCPA	✓	✓	✓	✓		✓	✓		✓		-	6	9	9	-	2	-	2	-	2	4	9	-	9	7	9	8	-	8	6	8	-	-	-	2	6	5	-	2	5	-	2	G
LONTREL + 2,4-D* <u>or</u> MCPA*	✓	✓									7	8	8	8	8	2	3	2	-	2	7	9	9	9	7	9	9	-	9	9	8	-	7	-	-	7	6	-	2	9	9	9	F
PARDNER <u>or</u> KORIL + 2,4-D* <u>or</u> MCPA*		✓	✓			✓	✓				6	8	9	8	-	2	2	2	-	2	8	9	9	9	9	9	9	-	9	9	9	-	7	1	-	7	6	-	2	6	8	0	F
REFINE SG + 2,4-D*		✓	✓			✓					-	9	9	8	7	9	6	9	7	9	9	9	9	9	7	9	9	-	9	9	8	7	7	8	-	7	6	-	2	8	8	-	F
REFINE M ¹	✓	✓	✓			✓					8	9	9	8	7	9	6	9	7	9	9	9	9	9	7	9	9	8	9	9	8	7	7	8	-	7	6	-	2	8	8	-	G

BOLD numbers indicate the weed is listed on the product label for control or suppression.

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

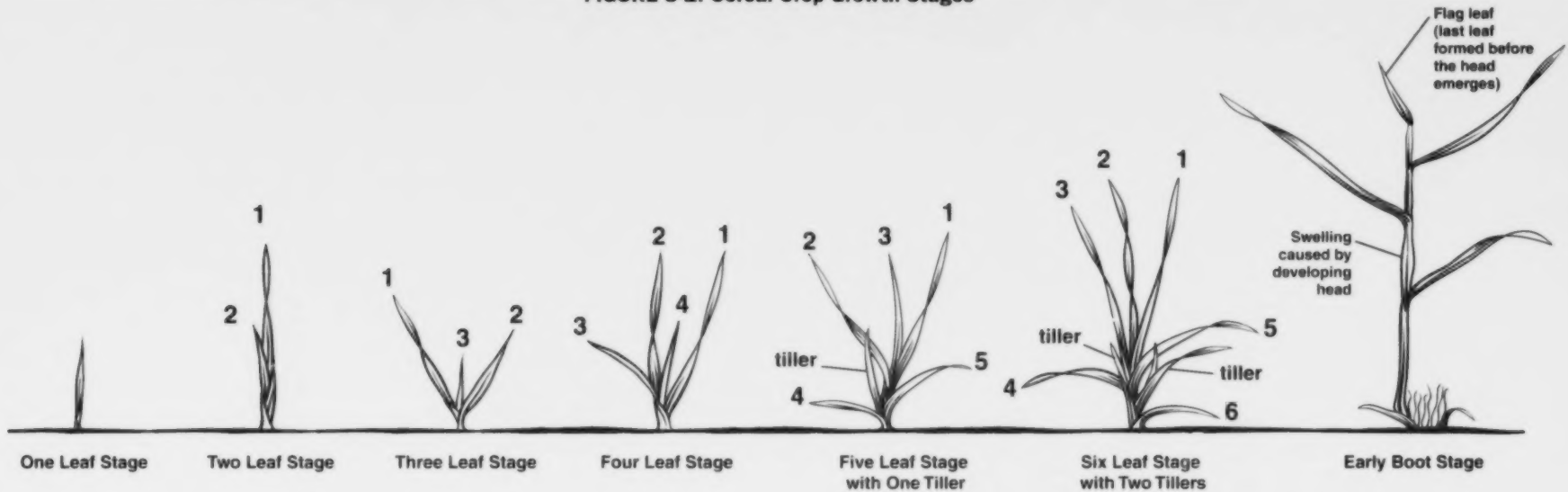
¹ Indicates product sold as a co-pack.

Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor.

- Insufficient information available to make a rating.

✓ Can be used on this crop.

FIGURE 8-1. Cereal Crop Growth Stages



Cereals

Apply all treatments in 100–200 L/ha (40–80 L/ac) of water except where otherwise noted.

Crop rotation is a valuable technique used to prevent the build up of weed populations associated with small grain production. Wild oats can increase in population and severely limit production on fields where small grains are grown continuously. Some weeds (e.g. proso millet) will be well controlled by cereal competition.

Blind harrowing with a light harrow, before emergence of cereals, can help to control small germinating weeds. A light harrow can also be used in cereals up to the 3 leaf stage, or a weeder harrow (L shaped flexible tines) at the 4 leaf stage to provide better control of small annual broadleaf weeds. The timing of these harrowing operations is critical. The weeds must be small and the soil surface must be dry and easily worked.

Weeds must be emerged from the soil surface and in early stages of growth to be killed by the rates of the herbicides used on cereal grains. Weeds that are growing during early periods of cereal growth (up to 5 leaf stage) have the greatest effect on the cereal yield.

The growth stage for maximum safety varies with the cereal and the herbicide. Check the label for appropriate timing. When counting the leaves on cereal plants, some confusion can occur if tiller leaves are present. These leaves are not counted. Figure 8-1, on this page, is useful for identifying the cereal leaf stages that are mentioned in this chapter.

Cereal grains have an advantage in that they do not make use of the full growing season. This is particularly true of the winter cereals where preplant cultivation and postharvest cultivation can be used to stimulate germination of weed seeds and reduce perennial weed populations.

Herbicide Application Timings

- **Preplant (PP)** – Also see *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.
- **Preplant Incorporated (PPI)**
- **Preemergence (PRE)**

Postemergence (POST) – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

CEREALS

Soil Applied Grass and Broadleaf Herbicides

TREFLAN (480 g/L)	0.8–1.14 L/ha	0.32–0.46 L/ac	• For use only on winter wheat.
or RIVAL DF (60 DF)	0.64–0.91 kg/ha	0.26–0.36 kg/ac	• For loose silky bentgrass control in the fall.
or BONANZA 400 (400 g/L)	0.96–1.37 L/ha	0.38–0.55 L/ac	• Apply as soon as possible after planting.
			• Incorporate shallowly into the soil surface with drag harrows.
trifluralin	0.383–0.546 kg/ha		• Seed the crop approximately 5 cm deep to separate the germinating seed from the chemical.

Postemergence Grass Herbicides

ACHIEVE LIQUID (400 g/L) plus TURBOCHARGE	0.5 L/ha 0.5 L/100 L	0.2 L/ac 0.5 L/100 L	• Do NOT use on tame oats, winter barley and fall rye. • Apply at 1–6 leaf stage of wild oats. • Apply in 50–100 L/ha of water. • Herbicides not listed on the label may be applied separately 7 days after application of ACHIEVE LIQUID. • Wild oat control will be reduced if REFINE SG is applied before ACHIEVE LIQUID. • Do NOT tank-mix REFINE SG with ACHIEVE LIQUID. • Do NOT feed or graze underseeded forage in year of treatment. • Mature straw may be fed to livestock. One application per year.
tralkoxydim plus adjuvant	0.2 kg/ha 0.5% v/v		
PUMA ¹²⁰ SUPER (120 g/L)	0.77 L/ha	0.31 L/ac	• For Use ONLY on spring wheat. • Use for control of wild oats and other grassy weeds. • Apply at the 1–6 leaf stage of spring wheat. • PUMA ¹²⁰ SUPER contains a safener that enhances the cereal crops ability to metabolize fenoxaprop-p-ethyl. Other products containing fenoxaprop-p-ethyl and that do not contain this special safener (i.e. EXCEL SUPER) will cause unacceptable levels of crop injury. • If using PUMA ADVANCE , apply at a rate of 1.02 L/ha (0.41 L/ac).
fenoxaprop-p-ethyl/safener	92.4 g/L		

Postemergence Broadleaf Herbicides

2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	0.75–1.8 L/ha 0.62–1.4 L/ha 0.53–1.29 L/ha	0.3–0.7 L/ac 0.25–0.56 L/ac 0.21–0.52 L/ac	• Do NOT use on oats, winter barley and cereals underseeded with legumes. • Apply when spring cereals are in the 3–5 leaf stage of growth.
2,4-D	0.35–0.85 kg/ha		FOR WINTER CEREALS: • Do NOT apply to seedling winter cereals in the fall. • For control of winter annuals apply early before flower buds appear on the weeds.
BANVEL II (480 g/L) or ORACLE (480 g/L)	0.23–0.29 L/ha	0.09–0.12 L/ac	• Do NOT use on winter barley, fall rye and cereals underseeded with legumes. • Control is best when weeds are in the 2–3 leaf stage or rosettes less than 5 cm diameter. Use the higher rates on older weeds.
dicamba	0.11–0.139 kg/ha		• Do NOT apply when night time air temperatures are below 10°C prior to and after application. • Apply to spring wheat and barley when they are in the 2–5 leaf stage. • Apply to winter wheat in the spring when the crop is 15–25 cm tall before the shot blade stage. • Underseeded seedling grasses should be at the 2–4 leaf stage.

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, page 23 for a complete list of available products.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
BUCTRIL M (560 g/L) or BADGE, LOGIC M, MEXTROL (450 g/L)	1 L/ha 1.25 L/ha	0.4 L/ac 0.5 L/ac	• Apply when weeds are in the 2–6 leaf stage and cereals are in the 2 to early flag leaf stage. For control of winter annual weeds, apply before flower buds appear. • Best results are obtained with applications at the 2–5 leaf cereal stage since thorough spray coverage of weed foliage is required for optimum weed control.
bromoxynil/ MCPA	0.56 kg/ha		UNDERSEEDED RED CLOVER (WINTER WHEAT ONLY): • Do NOT use on Fall Rye or Spring Cereals underseeded with red clover. • Apply in the spring when the red clover is in the 1st–3rd trifoliate stage and when the winter wheat provides a protective canopy over the clover. • Do NOT apply in less than 200 L/ha water (80 L/ac). • Do NOT apply if clover is under stress, and avoid overlaps as injury may result.
DYVEL (420 g/L)	1.25 L/ha	0.5 L/ac	• Do NOT use on fall rye, winter barley and cereals underseeded with legumes. • Apply when spring cereals are in the 2–5 leaf stage. • Hempnettle, corn spurry and cow cockle are controlled best when small. • Apply to winter wheat in the spring when weeds have emerged and the crop is 15–25 cm tall before the flag leaf stage. • Do NOT apply when night time air temperatures are below 10°C prior to and after application.
dicamba/ MCPA	0.525 kg/ha		
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L)	1.75–2.25 L/ha	0.7–0.9 L/ac	• Apply 2,4-DB at the 5 leaf to early flag stage of cereals. • Oats may be damaged if treated before the 5 leaf stage. • Apply when the legumes are in the 1–4 trifoliate stage. • Use only if cereals are underseeded to alfalfa, bird's foot trefoil, alsike or ladino clover and grasses. Red clover will be damaged by 2,4-DB. • Apply in 150–200 L/ha (60–80 L/ac) water. • Wild mustard plants are not controlled if sprayed when they are beyond the 4 leaf stage.
2,4-DB	1.1–1.4 kg/ha		
ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP (582 g/L)	1.75 L/ha	0.7 L/ac	• Do NOT use on oats, winter barley, fall rye and cereals underseeded with legumes. • Apply to emerged weeds at the 4 leaf to early flag leaf stage of spring cereals.
dichlorprop/ 2,4-D	1.017 kg/ha		FOR WINTER WHEAT: • Apply in early spring to emerged weeds. • May be used up to the early flag leaf stage.
INFINITY	0.83 L/ha	0.33 L/ac	• Do NOT use on oats, winter barley, fall rye or cereals underseeded with legumes. • Apply postemergence and prior to flag leaf emergence. • The addition of ammonium sulphate at 1 L/ha (0.4 L/ac) is required for the control of cleavers at the 4–6 whorl growth stage. • Do NOT graze the treated crops or cut for forage or hay within 25 days of application. • Do NOT harvest wheat or barley for grain or straw within 45 days of application.
pyrasulfotole/bromoxynil	213 g/ha		
LONTREL 360 (360 g/L)	0.42–0.56 L/ha	0.17–0.22 L/ac	• Do NOT use on oats, winter cereals or cereals underseeded with forage crops. • Apply when wheat or barley are at the 3 leaf to flag leaf emergence stages. • For the control of Canada thistle and perennial sow-thistle (top growth only).
clopyralid	0.15–0.2 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
MCPA (500 g/L)* MCPA (600 g/L)*	0.7–1.7 L/ha 0.58–1.4 L/ha	0.28–0.68 L/ac 0.23–0.56 L/ac	• Do NOT use on cereals underseeded with forage crops. • Apply when the crop is in the 2–5 leaf stage of growth. • For hempnettle control, use the high rate of MCPA.
MCPA	0.35–0.85 kg/ha		
MCPA SODIUM 300 (300 g/L)* MCPA	1–1.5 L/ha 0.3–0.45 kg/ha	0.4–0.6 L/ac	• For use on cereals underseeded to red clover. • Treat at an early stage of clover development when it is covered by a canopy of crop. • Apply in the spring when crop growth commences until early flag leaf stage. • Apply in 180–240 L/ha water (72–96 L/ac). • The lower rate may not kill ragweed.
MECOPROP (150 g/L) or COMPITOX (150 g/L) mecoprop-P	5.5–7 L/ha 0.83–1.05 kg/ha	2.2–2.8 L/ac	• Do NOT use on fall rye and cereals underseeded with forage crops. • Use from the 3 leaf stage to early flag leaf when cereals are 10–15 cm tall. • Apply when weeds are in the 2–4 leaf stage. • Use the higher rate for more mature weeds.
PARDNER (280 g/L) or BROTEX (240 g/L) or KORIL (235 g/L) bromoxynil	1–1.2 L/ha 1.2–1.4 L/ha 1.2–1.4 L/ha 0.28–0.336 kg/ha	0.4–0.48 L/ac 0.48–0.56 L/ac 0.48–0.56 L/ac	• Apply when the weeds are in the 1–4 leaf stage and cereals are in the 2 to early flag leaf stage. Use the higher rate when weeds are past the 4 leaf stage. • Spring Cereals: Best results are in the 2–5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control. • Winter Wheat: More effective on winter annuals when applied as a fall treatment.
REFINE SG (50%) plus non ionic surfactant thifensulfuron-methyl/ tribenuron-methyl plus non ionic surfactant	30 g/ha 2 L/1,000 L 15 g/ha 0.2% v/v	12 g/ac 2 L/1,000 L	• Do NOT use on winter barley, fall rye and cereals underseeded with forage crops. • Apply when the cereal crop is in the 2 leaf to flag leaf stage. • Winter Wheat: Apply once either in the fall or spring • Apply to young actively growing weeds that are less than 10 cm tall or across. • Canada thistle, sow thistle and round-leaved mallow are suppressed. • IF USING REFINE EXTRA, it must be applied at a rate of 20 g/ha or 8 g/ac plus a non ionic surfactant at 2 L per 1,000 L spray solution.
TARGET (400 g/L) or TRACKER XP (400 g/L) or SWORD (400 g/L) dicamba/ MCPA/ mecoprop	1–1.5 L/ha 0.4–0.6 kg/ha	0.4–0.6 L/ac	• Do NOT use on rye and cereals underseeded with forage crops. • Use when spring wheat or oats are in the 2–5 leaf stage or spring barley in the 2–4 leaf stage. • Winter Cereals: Apply in spring before the crop is more than 30 cm high (top leaf extended). • Apply when weeds are in the 2–3 leaf stage. • Use the high rate if weeds are beyond the 3 leaf stage. • Do NOT apply when night time air temperatures are below 10°C prior to and after application.
TROPHY ¹ TROPHY A (180 g/L) plus TROPHY B (500 g/L) fluroxypyr plus MCPA	0.6 L/ha 1.12 L/ha 108 g/ha 560 g/ha	0.24 L/ac 0.45 L/ac	• For use only on winter wheat. • Apply from the 3-tiller until the early flag leaf stage of winter wheat. • Do NOT apply to winter wheat underseeded to red clover. • Do NOT apply within 60 days of harvest and only once per year.

¹ Indicates product sold as a co-pack.

* Numerous products exist, refer to Table 4-1, *Herbicides Used in Ontario*, page 23 for a complete list of available products.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
TROPOTOX PLUS (400 g/L) or CLOVITOX PLUS (400 g/L) or TOPSIDE (400 g/L)	2.75–4.25 L/ha	1.1–1.7 L/ac	• Apply MCPB/MCPA from the 2 leaf stage to flag leaf stage of spring cereals. • Winter Cereals: Apply in the spring when the crop is in the 2 leaf to flag leaf stage. • Use only if cereals are underseeded to red, alsike, ladino or white dutch clover and grasses. • Apply when legumes are in the unifoliate to the 4th trifoliate leaf stage. • Apply in 150–200 L/ha (60–80 L/ac) water.
MCPB/MCPA	1.1–1.7 kg/ha		
Postemergence Tank-Mixes			
ACHIEVE LIQUID (400 g/L) plus BUCTRIL M (560 g/L) or BADGE, MEXTROL, LOGIC M (450 g/L) plus TURBOCHARGE	0.5 L/ha 1 L/ha 1.25 L/ha 0.5 L/100 L	0.2 L/ha 0.4 L/ac 0.5 L/ac 0.5 L/100 L	• Do NOT use on oats, winter barley or fall rye, winter barley or fall rye. • Apply when the wild oats are in the 1–6 leaf stage, broadleaf weeds in the 1–4 leaf stage and when the cereals are in the 2 to early flag leaf stage. • Refer also to precautions for BUCTRIL M, BADGE, MEXTROL and LOGIC M on page 100.
tralkoxydim plus bromoxynil/ MCPA plus mineral oil/surfactant	0.2 kg/ha 0.56 kg/ha 0.5% v/v		
ACHIEVE LIQUID (400 g/L) plus PARDNER (280 g/L) or KORIL (235 g/L) plus TURBOCHARGE	0.5 L/ha 1–1.12 L/ha 1.2–1.4 L/ha 0.5 L/100 L	0.2 L/ac 0.4–0.48 L/ac 0.48–0.56 L/ac 0.5 L/100 L	• Do NOT use on oats, winter barley or fall rye, winter barley or fall rye. • Apply when the wild oats are in the 1–6 leaf stage, broadleaf weeds in the 1–4 leaf stage and when the cereals are in the 2 leaf to early flag leaf stage. • Refer also to precautions for PARDNER, BROTEX and KORIL on page 101.
tralkoxydim plus bromoxynil plus mineral oil/surfactant	0.2 kg/ha 0.28–0.336 kg/ha 0.5% v/v		
BUCTRIL M (560 g/L) or BADGE, MEXTROL, LOGIC M (450 g/L) plus MCPA AMINE (500 g/L)	1 L/ha 1.25 L/ha 0.55 L/ha	0.4 L/ac 0.5 L/ac 0.22 L/ac	• Do NOT use on cereals underseeded with forage crops (including red clover). • Add MCPA for improved control of hempnettle (up to the 4 leaf stage) and volunteer canola (up to the 8 leaf stage). • Add MCPA to the spray tank first, followed by either BUCTRIL M, MEXTROL, BADGE or LOGIC M.
bromoxynil/ MCPA plus MCPA	0.56 kg/ha 0.28 kg/ha		
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L) plus MCPA AMINE (500 g/L)	1.25 L/ha 70 mL/ha	0.5 L/ac 28 mL/ac	• Apply when the legumes are in the 1–4 leaf stage. • Use if cereals are underseeded only to alfalfa, bird's foot trefoil, alsike or ladino clover and grasses. • The addition of MCPA gives better control of common mustard than 2,4-DB alone. • Apply in 150–200 L/ha (60–80 L/ac) water.
2,4-DB plus MCPA	0.8 kg/ha 35 g/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
INFINITY plus ACHIEVE LIQUID (400 g/L)	0.83 L/ha 0.5 L/ha	0.33 L/ac 0.2 L/ac	• Do NOT use on oats, winter barley, fall rye or cereals underseeded with legumes. • Apply postemergence and prior to flag leaf emergence. • The addition of ammonium sulphate at 1 L/ha (0.4 L/ac) is required for the control of cleavers at the 4–6 whorl growth stage. • Do NOT graze the treated crops or cut for forage or hay within 25 days of application. • Do NOT harvest wheat or barley for grain or straw within 45 days of application.
pyrasulfotole/bromoxynil plus tralkoxydim plus mineral oil/surfactant	213 g/ha 0.2 kg/ha 0.5% v/v		
LONTREL 360 (360 g/L plus 2,4-D (470 g/L)* or MCPA AMINE (500 g/L)*	0.28–0.69 L/ha 0.75–1.81 L/ha 0.7–1.7 L/ha	0.11–0.28 L/ac 0.3–0.72 L/ac 0.28–0.68 L/ac	• For use only on spring barley and wheat. • LONTREL is not registered for use on oats in Eastern Canada. • Do NOT use products containing 2,4-D on oats due to the probability of crop injury. • In combination with 2,4-D or MCPA, the lower rate of LONTREL 360 will provide control of Canada thistle for 6–8 weeks and the higher rate of LONTREL 360 will provide season long control of Canada thistle.
clopyralid plus 2,4-D or plus MCPA	0.1–0.25 kg/ha 0.35–0.85 kg/ha 0.35–0.85 kg/ha		
PARDNER (280 g/L) or BROTEX (240 g/L) or KORIL (235 g/L) plus 2,4-D (470 g/L)* or MCPA AMINE (500 g/L)*	1 L/ha 1.2 L/ha 1.2 L/ha 0.6 L/ha 0.55–1.1 L/ha	0.4 L/ac 0.48 L/ac 0.48 L/ac 0.24 L/ac 0.22–0.44 L/ac	• Do NOT use on winter barley, fall rye and cereals underseeded with forage crops. • Do NOT use the 2,4-D tank mix on oats. • Apply to cereals in the spring from the 4 leaf to early flag leaf stage. • Include 2,4-D or the lower rate of MCPA if mustards are present. • Use the higher rate of MCPA if hempnettle is present.
bromoxynil plus 2,4-D or plus MCPA	0.28 kg/ha 0.28 kg/ha 0.28–0.55 kg/ha		
PUMA ¹²⁰ SUPER (120 g/L) plus BUCTRIL M (560 g/L)	0.77 L/ha 1 L/ha	0.31 L/ac 0.4 L/ac	• For use ONLY on spring wheat. • Use for control of wild oats, grassy and broadleaf weeds. • Apply at the 1–6 leaf stage of spring wheat. • PUMA¹²⁰ SUPER contains a safener that enhances the cereal crops ability to metabolize fenoxaprop-p-ethyl. Other products containing fenoxaprop-p-ethyl and that do not contain this special safener (i.e. EXCEL SUPER) will cause unacceptable levels of crop injury.
fenoxaprop-p-ethyl/SAFENER	92.4 g/L		
REFINE SG (50%) 2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)* plus non ionic surfactant	30 g/ha 0.84–1.1 L/ha 0.7–0.9 L/ha 0.6–0.8 L/ha 2 L/1,000L	12 g/ac 0.34–0.45 L/ac 0.28–0.36 L/ac 0.24–0.32 L/ha 2 L/1,000L	• Do NOT use on winter barley, fall rye and cereals underseeded with forage crops. • Do NOT apply 2,4-D tank-mix on oats. • Apply tank-mixes from the full 3 leaf stage to the flag leaf stage of the crop. • Apply tank-mixes from the full 3 leaf stage to the 5 leaf stage of the crop. • IF USING REFINE EXTRA, it must be applied at a rate of 20 g/ha or 8 g/ac plus a non ionic surfactant at 2 L per 1,000 L spray solution.
thifensulfuron-methyl/ tribenuron-methyl plus 2,4-D* plus non ionic surfactant	15 g/ha 0.42–0.55 kg/ha 0.2% v/v		

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, page 23 for a complete list of available products.

POSTEMERGENCE TANK MIXES

8. CEREAL CROPS

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
REFINE M [†]			• Do NOT use on winter barley, fall rye and cereals underseeded with forage crops. • Apply tank-mixes from the full 3 leaf stage to the flag leaf stage of the crop. • Apply tank-mixes from the full 3 leaf stage to the 5 leaf stage of the crop. • IF USING REFINE EXTRA, it must be applied at a rate of 20 g/ha or 8 g/ac plus a non ionic surfactant at 2 L/1,000 L spray solution.
REFINE SG (50%)	30 g/ha	12 g/ac	
plus MCPA (500 g/L)*	0.7–1.1 L/ha	0.28–0.45 L/ac	
plus non ionic surfactant	2 L/1,000L	2 L/1,000L	
thifensulfuron-methyl/ tribenuron-methyl	15 g/ha		
plus MCPA*	0.35–0.55 kg/ha		
plus non ionic surfactant	0.2% v/v		
Preharvest			
AIM EC (240 g/L)	73–117 mL/ha	30–47 mL/ac	• Apply to actively growing weeds, up to 10 cm. • Coverage of weed and crop foliage is essential for control. • Preharvest interval (PHI) is 3 days.
plus non-ionic surfactant	2.5 L/1,000 L	2.5 L/1,000 L	
or MERGE	10 L/1,000 L	10 L/1,000 L	
carfentrazone-ethyl	0.0175–0.028 kg/ha		
plus non-ionic surfactant	0.25% v/v		
or MERGE	0.1% v/v		
glyphosate (360 g/L)	2.5 L/ha	1 L/ac	• Apply in 50–100 L/ha (20–40 L/ac) water when crop is at 30% grain moisture or less. • Apply at least 7 days prior to harvest and use ground application only. • Do NOT apply to seed crops.
or glyphosate (450 g/L)	2 L/ha	0.8 L/ac	
or glyphosate (480 g/L)	1.88 L/ha	0.75 L/ac	
or glyphosate (500 g/L)	1.8 L/ha	0.72 L/ac	
or glyphosate (540 g/L)	1.67 L/ha	0.67 L/ac	
glyphosate	0.9 kg/ha		

[†] Indicates product sold as a co-pack.

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, page 23 for a complete list of available products.



9. CORN (FIELD, SEED & SWEET)

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Crop tolerance ratings are: E – Excellent, G – Good, F – Fair, P – Poor. Under unfavourable conditions (e.g. too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 9-1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings

Trade Name	Crop			Annual Grasses									Annual Broadleaves										Perennials							Crop Tolerance			
	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass		sow-thistle	thistle, Canada	
Preplant Burndown Herbicides – Refer to Tables 6-1. Non-Selective Herbicides Available for Preplant Site Preparation, page 77 and 6-2. Preplant Herbicide Weed Control Ratings, page 79 for a list of herbicides and weed control ratings.																																	
Soil Applied Grass and Broadleaf Herbicides (Preemergence Timing Only)																																	
PRINCEP NINE-T, SIMADEx, SIMAZINE 480	✓	✓	✓	9	8	8	7	9	9	9	9	2	9	7	9	-	9	9 ^R	9	9	9 ^R	8 ^R	-	5	2	0	0	5	5	2	2	E	
Soil Applied Tank-Mixes (Preemergence Timing Only)																																	
DUAL II MAGNUM + LOROX + atrazine*	✓			9	9	9	8	8	9	9	9	2	9	7	9	-	9	9	9	9	9	9	-	7	0	0	0	7	0	0	0	E	
PRIMEXTRA II MAGNUM + LOROX		✓		9	9	9	8	8	9	9	9	2	9	7	9	-	9	9	9	9	9	9	-	7	0	0	0	7	0	0	0	E	
Soil Applied Broadleaf Herbicides (Preemergence timing only)																																	
atrazine*	✓	✓	✓	2	2	2	2	2	2	2	2	2	9	7	9	-	9	9 ^R	9	9	9 ^R	9 ^R	6	5	2	0	0	0	0	2	2	0	E
BANVEL II, ORACLE			✓	0	0	0	0	0	0	0	0	0	8	7	8	-	9	9	6	9	9	9	7	8	2	0	0	0	0	0	2	2	G

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^a Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

^a Use the high rate of herbicide for optimum control.

^a PPI timing is needed to achieved this level of control.

^c Use PRE timing for optimum control.

^a The addition of atrazine is required to achieve this level of control.

^a Weed must be emerged to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 9-1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

Trade Name	Crop			Annual Grasses									Annual Broadleaves												Perennials							Crop Tolerance	
	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	flabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada		
CALLISTO + atrazine	✓	✓	✓	2	0	4	0	2	2	2	2	2	8	7	-	-	9	9	9	9	9	9	8	8	9	2	0	0	0	0	0	0	E
MARKSMAN or PROPERO			✓	2	2	2	2	2	2	2	2	2	9	7	9	-	9	9	9	9	9	9	9	7	8	2	0	0	0	2	2	2	G
Soil Applied and Early Postemergence Grass Herbicides																																	
DUAL II MAGNUM	✓	✓	✓	9	9	9	8 ^a	8	9	9	9	4	2	2	2	-	2	7	2	8/9	7/8	4	3	3	0	0	0	8 ^b	0	0	0	E	
FRONTIER MAX	✓	✓	✓	9	9	9	8 ^a	8	9	9	9	4	2	2	2	-	2	7	2	8/9	7/8	4	3	3	0	0	0	8 ^b	0	0	0	E	
PROWL			✓	9	9	9	9	8	8	8	-	5	-	-	-	-	6	9	0	8	8	2	-	6	-	-	-	-	-	-	-	E	
Soil Applied and Early Postemergence Grass and Broadleaf Herbicides																																	
BATTALION ¹			✓	9	8	8	9	8	8	8	9	9 ^c	9	-	8	-	8	9	8	8	9	9	7	8	-	-	-	-	7 ^e	7 ^e	-	G	
CONVERGE XT ¹			✓	9	9	9	9	9	9	9	9	8	8	6	-	8	9	9	9	9	9	9	7	9	-	0	0	0	0	0	0	G	
CONVERGE FLEX + atrazine*			✓	9	9	9	9	9	9	9	9	8	8	6	-	8	9	9	9	9	9	9	7	9	-	0	0	0	0	0	0	G	
PRIMEXTRA II MAGNUM	✓	✓	✓	9	9	9	8	8	9	9	9	2	9	7	9	-	9	9 ^d	9	9	9	9	9 ^d	-	2	0	0	0	8 ^b	0	0	0	E
Soil Applied and Early Postemergence Tank-Mixes																																	
DUAL II MAGNUM + BANVEL II or ORACLE			✓	9	9	9	8 ^a	8	8	8	9	2	9	9	9	9	9	6	9	9	9	9 ^e	9 ^e	8 ^a	0	0	8 ^b	0	9 ^c	8 ^c		G	
DUAL II MAGNUM + CALLISTO + atrazine*			✓	9	9	9	8 ^a	8	8	8	9	4	9	8	-	-	9	9	9	9	9	9	8 ^c	9	2	0	0	8 ^b	0	0	0		E
DUAL II MAGNUM + MARKS- MAN or PROPERO			✓	9	9	9	8 ^a	8	8	8	9	2	9	9	9	9	9	9	9	9	9	9 ^e	9 ^e	8 ^a	0	0	8 ^b	0	8 ^c	8 ^c		G	
FRONTIER MAX + atrazine*		✓		9	9	9	8	8	9	9	9	2	9	7	9	-	9	9 ^d	9	9	9	9 ^d	6	5	2	0	0	8 ^b	2	2	0		E
FRONTIER MAX + BANVEL II			✓	9	9	9	8 ^a	8	8	8	9	2	9	9	9	9	9	6	9	9	9	9 ^e	9 ^e	8 ^a	0	0	8 ^b	0	9 ^c	8 ^c		G	
FRONTIER MAX + MARKSMAN			✓	9	9	9	8 ^a	8	8	8	9	2	9	9	9	9	9	9	9	9	9	9	9 ^e	9 ^e	8 ^a	0	0	8 ^b	0	8 ^c	8 ^c		E

* Various formulations available, see Table 4-1. Herbicides Used in Ontario, page 23. See label for specific uses and rates.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^d Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

^a Use the high rate of herbicide for optimum control.

^b PPI timing is needed to achieved this level of control.

^c Use PRE timing for optimum control.

^d The addition of atrazine is required to achieve this level of control.

^e Weed must be emerged to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 9-1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

Trade Name	Crop			Annual Grasses									Annual Broadleaves										Perennials							Crop Tolerance			
	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass		sow-thistle	thistle, Canada	
PRIMEXTRA II, MAGNUM + BANVEL II or ORACLE			✓	9	9	9	8 ^a	8	8	8	9	2	9	9	9	9	9	9	9	9	9	9	9	9 ^a	8 ^a	0	0	8 ^b	0	8 ^c	8 ^d	G	
PRIMEXTRA II MAGNUM + CALLISTO	✓	✓	✓	9	9	9	8 ^a	8	8	8	9	4	9	8	7 ^e	-	9	9	9	9	9	9	8 ^e	9	2	0	0	8 ^b	0	0	0	E	
PROWL + atrazine*			✓	9	8	8	9	8	8	8	7	5	9	7	9	-	9	9	9	9	9	9 ^R	6	6	2	-	-	-	2	2	-	E	
PROWL + BANVEL II or ORACLE			✓	9	8	8	9	8	8	8	-	5	8	8	8	9	9	9	6	9	9	9	9 ^e	9 ^e	-	-	-	-	-	-	-	E	
PROWL + MARKSMAN			✓	9	8	8	9	8	8	8	8	5	9	8	9	9	9	9	9	9	9	9	9 ^e	9 ^e	-	-	-	-	-	-	-	E	
Postemergence Grass Herbicides																																	
ACCENT	✓	✓ ³	✓	9	0	7/8	9	9 ^R	9 ^R	8	9	9	0	0	0	0	0	0	0	0	9 ^R	0	0	0	0	0	0	0	0	9	0	0	E
ULTIM			✓	9	0	7/8	9	9 ^R	9 ^R	7	9	9	-	-	-	-	5	5	7	2	9 ^R	-	-	5	-	-	7	-	9	-	-	G	
Postemergence Broadleaf Herbicides																																	
2,4-D*			✓	0	0	0	0	0	0	0	0	0	4	8	2	-	4	9	9	7	9	8	-	8	7	0	0	0	0	0	8	8	F
2,4-DB* (CALIBER, COBUTOX, EMBUTOX)			✓	0	0	0	0	0	0	0	0	0	4	8	0	-	0	7	8	7	9	8	-	8	8	0	0	0	0	0	8	8	G
atrazine* + oil	✓	✓	✓	4	4	4	0	4	4	4	4	4	9	7	9	-	9	9 ^R	9	9	9 ^R	9 ^R	8	7	7	5	2	5	5	7	2	G	
BANVEL II, ORACLE			✓	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	6	9	9	9	9	9	8	0	0	0	0	0	9	8	G
BASAGRAN FORTÉ	✓	✓	✓	0	0	0	0	0	0	0	0	0	7	9	9	5	9	7	9	7	8 ^R	8	8	9	6	0	0	6	0	6	8	E	
BUCTRIL M, BADGE, LOGIC M, MEXTROL			✓	0	0	0	0	0	0	0	0	0	9	9	-	-	9	9	9	9	8	9	-	9	7	7	0	0	0	0	7	7	F
CALLISTO + atrazine	✓	✓	✓	2	0	4	0	2	2	2	2	2	8	8	-	-	9	9	9	9	9	8	7	9	2	0	0	0	0	0	0	0	E
DISTINCT			✓	-	-	-	-	-	-	-	-	-	9	9	9	9	9	9	6	9	9	9	9	9	8	0	0	0	0	0	9	9	E

* Various formulations available, see Table 4-1. Herbicides Used in Ontario, page 23. See label for specific uses and rates.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^a Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

* Use the high rate of herbicide for optimum control.

^b PPI timing is needed to achieved this level of control.

^c Use PRE timing for optimum control.

^d The addition of atrazine is required to achieve this level of control.

^e Weed must be emerged to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 3-1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

Trade Name	Crop			Annual Grasses									Annual Broadleaves										Perennials							Crop Tolerance			
	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass		sow-thistle	thistle, Canada	
IMPACT + atrazine*	✓	✓		7	7	7	7	8	7	7	7	7	8	9	-	9	9	9	9	9	9	9	9	9	7	-	-	-	-	-	-	-	E
LADDOK	✓	✓	✓	0	0	0	0	0	0	0	0	0	9	9	9	-	9	9	9	9	9 ^a	9	-	9	7	0	0	6	0	7	7	E	
MARKSMAN or PROPERO			✓	7	0	0	0	7	7	7	7	0	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	0	8	8	E	
MCPA*			✓	0	0	0	0	0	0	0	0	0	2	7	7	-	0	9	9	-	7	9	-	7	7	6	0	0	0	7	7	P	
PARDNER, KORIL	✓	✓	✓	0	0	0	0	0	0	0	0	0	9	8	-	-	9	9	8	9	8 ^a	9	-	9	7	0	0	0	0	7	7	E	
PEAKPLUS ¹			✓	0	0	0	0	0	0	0	0	0	-	9	-	-	9	9	9	-	9	9	9	9	-	-	-	0	0	-	-	E	
SHOTGUN			✓	0	0	0	0	0	0	0	0	0	9	7	-	-	9	9	9	9	9	9	-	9	0	-	0	0	0	-	-	G	
TROPOTOX PLUS, CLOVITOX PLUS, TOPSIDE			✓	0	0	0	0	0	0	0	0	0	8	8	0	-	0	7	8	7	9	9	-	9	8	0	0	0	0	8	8	G	
Postemergence Tank-Mixes																																	
ACCENT + BANVEL II,			✓	9	0	7/8	9	9 ^a	9 ^a	8	9	9	9	9	9	9	9	6	9	9	9	-	9	8	0	0	0	9	9	8		G	
ACCENT + CALLISTO +atrazine*			✓	9	0	7/8	9	9 ^a	9 ^a	8	9	9	8	8	-	-	9	9	9	9	9	8	-	9	2	0	0	0	9	0	0	E	
ACCENT + DISTINCT, ACCENT TOTAL ¹			✓	9	0	7/8	9	9 ^a	9 ^a	8	9	9	9	9	9	9	9	6	9	9	9	9	9	8	0	6	0	9	9	9		E	
ACCENT + MARKSMAN			✓	9	0	7/8	9	9 ^a	9 ^a	7	9	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	9	8	8		E	
ACCENT + PARDNER			✓	9	0	7/8	9	9 ^a	9 ^a	8	9	9	9	8	-	-	9	9	8	9	8	9	-	9	7	0	0	0	9	7	7	E	
ACCENT + PEAKPLUS ¹ , ACCENT ONE PASS ¹			✓	9	0	7/8	9	9 ^a	9 ^a	8	9	9	-	9	-	-	9	9	9	8 ^d	9	9	9	9	5	0	0	0	9	0	0	E	
ACCENT + SHOTGUN			✓	7	-	-	9	-	7 ^a	7	-	-	9	7	-	-	9	9	9	9	9	9	-	9	0	-	0	0	9	-	-	G	
atrazine* + BANVEL II or ORACLE			✓	4	4	4	0	4	4	4	4	4	9	9	9	9	9	9	9	9	9	9	9	8	5	2	5	5	9	8		G	

* Various formulations available, see Table 4-1. Herbicides Used in Ontario, page 23. See label for specific uses and rates.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

* Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

^a Use the high rate of herbicide for optimum control.

^b PPI timing is needed to achieved this level of control.

^c Use PRE timing for optimum control.

^d The addition of atrazine is required to achieve this level of control.

^e Weed must be emerged to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 9-1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

Trade Name	Crop			Annual Grasses									Annual Broadleaves										Perennials						Crop Tolerance			
	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge		quackgrass	sow-thistle	thistle, Canada
atrazine* + BUCTRIL M or BADGE or LOGIC M or MEXTROL			✓	4	4	4	0	4	4	4	4	4	9	9	9	7	9	9	9	9	9	9	-	9	7	7	2	5	5	7	7	F
atrazine* + PARDNER or KORIL	✓	✓	✓	4	4	4	0	4	4	4	4	4	9	8	9	7	9	9	9	9	9	9	-	9	7	5	2	5	5	7	2	E
BANVEL II or ORACLE + 2,4-D*			✓	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	0	9	8	F
BANVEL II + PARDNER, KORIL or BROTEX			✓	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	8	9	9	9	-	9	8	0	0	0	0	9	8	G
IMPACT + FRONTIER MAX + atrazine*			✓	9	9	9	9	8	9	9	9	-	8	9	-	9	9	9	9	9	9	9	9	7	-	-	-	-	-	-	-	E
OPTION 1.2.3.			✓	9	7	7	9	9	9	9	9	7	9	-	-	-	9	9 ^R	9	9	9	9	9	7	-	0	0	0	-	-	-	E
OPTION + atrazine*			✓	9	0	7	9	9 ^R	9 ^R	7	9	9	9	9	-	-	9	9 ^R	9	9	9 ^R	9	-	9	7	5	2	5	7/8	7	2	E
OPTION + BANVEL II			✓	9	0	7	9	9 ^R	9 ^R	8	9	9	9	9	9	9	9	9	9	9	9	9	-	9	8	0	0	0	9	9	8	G
OPTION + CALLISTO + atrazine*			✓	9	0	7	9	9 ^R	9 ^R	8	9	9	8	8	-	-	9	9	9	9	9	9	8	9	2	0	0	0	9	0	0	E
OPTION + DISTINCT			✓	9	0	7	9	9 ^R	9 ^R	8	9	9	8	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	9	0	0	G
OPTION + MARKSMAN			✓	9	0	7	9	9 ^R	9 ^R	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	-	-	0	7/8	8	8	E
OPTION + PARDNER + atrazine*			✓	9	0	7	9	9 ^R	9 ^R	7	9	9	9	8	-	-	9	9	9	9	9	9	-	9	7	5	2	5	8	7	5	E
OPTION + PEAKPLUS ¹			✓	9	0	7	9	9 ^R	9 ^R	8	9	9	-	9	-	-	9	9	9	9	9	9	9	9	-	-	7	0	9	-	-	E
PROWL + ACCENT + BANVEL II or ORACLE			✓	9	9	9	9	8	8	8	9	7	8	8	8	9	9	9	6	9	9	9	9	8	-	-	-	-	-	-	-	G
PROWL + SHOTGUN			✓	9	8	8	9	8	8	8	7	5	9	7	-	-	9	9	9	9	9	9	-	9	0	-	0	0	0	-	-	G
ULTIM + BANVEL II, ORACLE			✓	9	0	7/8	9	9 ^R	9 ^R	7	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	0	0	0	9	9	8	G
ULTIM + CALLISTO + atrazine*			✓	9	0	7/8	9	9 ^R	9 ^R	7	9	9	8	8	-	-	9	9	9	9	9	8	8	9	-	-	7	-	9	-	-	G

* Various formulations available, see Table 4-1, *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^a Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

* Use the high rate of herbicide for optimum control.

^b PPI timing is needed to achieve this level of control.

^c Use PRE timing for optimum control.

^d The addition of atrazine is required to achieve this level of control.

^e Weed must be emerged to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 9-1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

Trade Name	Crop			Annual Grasses									Annual Broadleaves										Perennials							Crop Tolerance		
	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass		sow-thistle	thistle, Canada
ULTIM + DISTINCT, ULTIM TOTAL ¹		✓		9	0	7/8	9	9 ^R	9 ^R	7	9	9	9	9	9	9	9	7	9	9	9	9	9	9	8	8	6	0	9	9	9	G
ULTIM + MARKSMAN		✓		9	0	7/8	9	9 ^R	9 ^R	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	9	8	8	G
ULTIM + PARDNER		✓		9	0	7/8	9	9 ^R	9 ^R	7	9	9	9	8	-	-	9	9	8	9	8	9	-	9	7	0	0	0	9	7	7	G
ULTIM + PARDNER + atrazine*		✓		9	0	7/8	9	9 ^R	9 ^R	7	9	9	9	8	9	-	9	9	9	9	9	9	-	9	7	5	2	5	9	7	2	G
ULTIM + PEAKPLUS ¹		✓		9	0	7/8	9	9 ^R	9 ^R	7	9	9	-	9	-	-	9	9	9	-	9	9	9	9	-	-	7	-	9	-	-	G
ULTIM + SHOTGUN		✓		8	0	7/8	8	-	9 ^R	7	-	-	9	7	-	-	9	9	9	9	9	9	-	9	0	-	7	0	9	-	-	G

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

✓ Can be used on this crop.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^a Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

^a Use the high rate of herbicide for optimum control.

^b PPI timing is needed to achieved this level of control.

^c Use PRE timing for optimum control.

^d The addition of atrazine is required to achieve this level of control.

^e Weed must be emerged to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 9-2. Additional Weed Control Ratings for Conventional Corn (Field, Seed and Sweet)

	Volunteer Crops		Grasses			Annual and Biennial Broadleaves											Perennials				
Trade Name	adzuki beans (volunteer)	wheat (volunteer)	sandbur	stink grass	tufted love grass	bur-cucumber	biennial wormwood	chickweed, common	flower of an hour	lettuce, prickly	nipplewort	spreading atriplex	swamp smartweed	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	horsenettle	red top	vetch, tufted	wirestem muhly
Soil Applied Grass Herbicides																					
DUAL II MAGNUM	-	-	5	9	9	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-
FRONTIER MAX	-	-	5	9	9	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-
PROWL	-	6	6	9	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil Applied Broadleaf Herbicides																					
atrazine*	-	2	-	-	-	5	-	9	-	-	-	-	2	9	0	-	9	-	-	-	-
CALLISTO + atrazine	-	2	-	-	-	-	-	-	-	-	-	-	4	9	9	-	-	-	0	-	0
MARKSMAN, PROPERO	-	2	-	-	-	5	-	9	-	-	-	6	3	9	8	-	9	-	-	-	-
Soil Applied Grass and Broadleaf Herbicides																					
BATTALION ¹	-	8	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CONVERGE XT ¹ or CONVERGE FLEXX + atrazine*	-	2	6	-	-	5	-	9	-	-	-	7	4	9	9	-	9	-	-	-	-
PRIMEXTRA II MAGNUM	-	2	6	-	-	5	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-
Postemergence Grass Herbicides																					
ACCENT	-	7 ^a	7	9	9	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	6
OPTION 2.25 OD	-	7 ^a	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	9
ULTIM	-	7 ^a	8	9	9	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	6
Postemergence Broadleaf Herbicides																					
atrazine* + oil	-	2	-	-	-	5	8	9	7	-	9	2	0	9	0	2	9	-	-	-	-
BANVEL II, ORACLE	-	0	-	-	-	2	9	9	9	8	9	7	6	7	9	6	9	-	-	8	-
CALLISTO + atrazine	9	2	-	-	-	4	-	9	-	-	6	5	-	0	9	8	-	-	0	6	0
DISTINCT	-	-	-	-	-	2	9	9	9	8	9	7	5	9	9	8	-	5	-	8	-

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

¹ Indicates herbicides sold as a co-pack under this trade name.

- Insufficient information available to make a rating.

^a Use the high rate of herbicide for optimum control.

^b To achieve this level of control, volunteer cereals must be sprayed prior to flag leaf.

^c Volunteer cereals are close to heading when these products are normally applied, earlier applications will improve control.

TABLE 9-2. Additional Weed Control Ratings For Conventional Corn (Field, Seed and Sweet) (cont'd)

	Volunteer Crops		Grasses			Annual and Biennial Broadleaves												Perennials			
Trade Name	adzuki beans (volunteer)	wheat (volunteer)	sandbur	stink grass	tufted love grass	bur-cucumber	biennial wormwood	chickweed, common	flower of an hour	lettuce, prickly	nipplewort	spreading atriplex	swamp smartweed	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	horsenettle	red top	vetch, tufted	wirestem muhly
LADDOK	-	-	-	-	-	6	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MARKSMAN, PROPERO	-	-	-	-	-	6	9	9	9	9	9	7	3	9	9	9	-	-	-	8	-
PARDNER + atrazine*	-	-	-	-	-	8	9	9	9	8	9	9	1	9	9	7	-	-	-	-	-
PEAKPLUS ¹	-	-	-	-	-	3	8	9	8	8	6	7	6	8	6	9	-	-	-	7	-
SHOTGUN	-	-	-	-	-	6	9	9	9	8	9	-	0	9	9	-	-	-	-	-	-
Postemergence Grass and Broadleaf Herbicide Tank-Mixes																					
ACCENT + CALLISTO + atrazine*	9	7 ^c	8	9	9	-	-	-	-	-	-	-	5	-	9	8	-	-	-	-	-
BATTALION ¹	-	8 ^b	8	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	-	-	-
ULTIM + BANVEL II, ORACLE	-	7 ^c	8	9	9	-	-	-	-	-	-	-	-	7	-	-	-	7	-	-	6
ULTIM + CALLISTO + atrazine*	9	7 ^c	8	9	9	-	-	-	-	-	-	-	-	-	9	8	-	-	-	-	6
ULTIM + DISTINCT, ULTIM TOTAL ¹	-	7 ^c	8	9	9	-	-	-	-	9	-	-	5	9	-	-	-	8	-	-	6
ULTIM + MARKSMAN	-	7 ^c	8	9	9	6	-	-	-	-	-	-	5	9	-	-	-	7	-	-	6
ULTIM + PEAKPLUS ¹	-	7 ^c	8	9	9	-	-	-	-	-	-	-	-	8	-	-	-	7	-	-	6

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

¹ Indicates herbicides sold as a co-pack under this trade name.

- Insufficient information available to make a rating.

* Use the high rate of herbicide for optimum control.

^b To achieve this level of control, volunteer cereals must be sprayed prior to flag leaf.

^c Volunteer cereals are close to heading when these products are normally applied, earlier applications will improve control.

Conventional Corn (Field, Seed and Sweet)

Critical Stage: The Critical Stage to control weeds in corn is the 2–8 leaf over stage (3–10 leaf tips).

Apply all treatments in 150–300 L/ha (60–120 L/ac) water unless otherwise specified.

Any single method of weed control or the continuous use of the same chemicals can lead to the build-up of weeds resistant or tolerant to that control method. Triazine-resistant lamb's-quarters and pigweed are problematic due to continuous corn and repeated use of triazine herbicides. Rotating to other crops and/or other control methods reduces the chance of new or unique weed infestations.

To control small annual weed seedlings, blind harrow with a set of light harrows at a shallow depth before the corn has emerged, or use a weeder harrow (with L-shaped flexible tines) when the crop is 5–10 cm high. High speed (10 kph), shallow (2.5–3 cm) cultivation with the rotary hoe when corn is 7–8 cm high also helps control small weed seedlings. These techniques will not reduce herbicide action and may in some years enhance chemical weed control. Inter-row cultivation can be used to complement other weed control measures. Row cultivation is most effective when weeds are small. Shallow cultivation will reduce:

- germination of new weed seeds
- moisture loss
- corn root injury

Inter-row cultivation may be required when weeds escape herbicide treatment; consider weeds escapes when they are 5–7 cm high.

Band treatment of chemical over the row reduces cost by one-half to two-thirds, depending on the row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation gives some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another. Many perennials (i.e. nutsedge) can be spread on tillage equipment. Custom operators should be particularly careful when moving from one farm to another.

Seed Corn Recommendations

Some field corn recommendations are applicable to seed corn, however, there are inbreds which are susceptible to some chemicals. Check with the contracting company before applying any herbicide. For information on specific weeds see Table 9-1. *Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings*, page 105, and then refer to the appropriate section for details about herbicide treatment.

Nitrogen solution can be used as a carrier, instead of water, for preplant and preemergence application of some herbicides. Weed control activity is not increased. Spray before crop emergence. Consult the herbicide label for proper methods of application and use of dispersing agents. Calibrate the sprayer to apply the required amount of nitrogen. Use stainless steel flood jet nozzles of adequate size (e.g. Teejet TK SS 5 to TK SS 10). Nitrogen solution is mildly corrosive, especially to brass; clean the sprayer immediately after use. UNITE may be used to improve liquid fertilizer herbicide compatibility and stability when a simultaneous application of a liquid fertilizer and liquid or wettable powder herbicide is desired. Because formulations and rates vary, it is essential to read the label to determine the exact amount and method to be used.

Do not apply nitrogen solution with postemergence herbicides.

Special Notes For Corn, Field and Sweet

PRECAUTIONS: Do not use 2,4-D, MCPA, MCPB, 2,4-DB or dicamba later than 2 weeks prior to the first appearance of tassels or ear silk. Use extreme care when applying these herbicides near susceptible crops because of possible herbicide movement. Soybeans, tomatoes and tobacco are extremely sensitive to dicamba and injury symptoms may persist for several weeks. Do not use dicamba in the area of susceptible crops when temperatures exceed 25°C on the day of application or if high humidity is expected, due to the possibility of dicamba volatilizing and injuring susceptible crops nearby. Leave several rows of corn unsprayed when adjacent to soybean fields or other susceptible crops.

Atrazine and Simazine Soil Residues

Atrazine and simazine residues may last for more than one year, particularly if high rates are used more than once and dry weather occurs. If atrazine or simazine is used year after year as in a continuous corn program, triazine residues may be higher. Atrazine when used at rates from 1.2–1.5 kg/ha (active ingredient) on corn generally has not caused injury on succeeding crops of oats, barley, mixed grains, or soybeans, except in years where there was very little rain the previous fall which would slow down atrazine degradation in the soil. Postemergence treatments may persist longer than preemergence treatments. Variations from this generality of 1.2–1.5 kg/ha atrazine may occur across the province.

Injury has been reported on tomatoes, white beans, forage seedlings, peas, tobacco, cucumbers, onions, and turnips following applications of atrazine at more than 1.1 kg/ha (active ingredient) on corn the previous year.

To reduce the hazard of atrazine residues on succeeding crops:

- Apply the early postemergence atrazine oil-water treatment with the lower rate of atrazine: 1.1 kg/ha (active ingredient). With this lower rate, a lower measure of weed control may result and cultivation may be necessary.
- Fall plowing will reduce TRIAZINE injury more than spring plowing will.
- Moldboard plowing will disperse herbicide residue to a greater soil depth than chisel plowing, thus reducing the concentration of herbicide in the upper soil area.
- Ensure that the sprayer used is adequate and is properly calibrated and adjusted. Spray uniformly without overlaps and do not spray while the sprayer is stopped.

Herbicide Treatments Include

- **Preplant (PP)** – Also see *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.
- **Preplant Incorporated (PPI)** – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Pay special attention toward machinery cleanliness, and/or treating fields with perennial weeds last.
- **Preemergence (PRE)** – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing controls weed escapes

and improves herbicide activity in the absence of rainfall.

- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Corn Leaf Stages

Counting leaves on a corn plant may sound like an easy task, but there are complications that can cause miscounting. There are several methods of counting leaves. It is important to know which leaf counting method is being referred to.

This publication uses the leaf over method, (see Figure 9-1. Leaf Over Method of Counting Corn Leaves, on page 115) where counting starts with leaves that have emerged from the whorl and the leaf tip is starting to arch over. This normally occurs when leaves are about 50% emerged. Most product labels also use this method of leaf counting, but check the label or with the product representative to be sure. The comparative growth stages table in the next column gives a comparison among the count methods.

Another complication with leaf counting is where on the plant leaf counting begins. In this publication, the first leaf is the bottom leaf of the plant. The first leaf is shorter than other leaves and has a round leaf tip. However, as the plant grows the bottom leaves die and drop to the ground. For example, a 10 leaf corn plant may be incorrectly identified as a 7 leaf corn plant because 3 leaves may be “senesced” or fallen off. These leaves may

not be immediately apparent and care must be taken to count them.

Start counting from the bottom leaf and check the first leaf to look for the rounded leaf tip.

It takes about 75–80 Crop Heat Units to produce each corn leaf. Therefore at temperatures of 30°C day, and 20°C at night, there is one new leaf every 2–3 days; and at 20°C day, and 10°C at night, one new leaf every 5–6 days.

The Critical Weed-Free Period in corn is from the 3–8 leaf over stage.

Some product labels also use plant height to indicate crop growth stages. In general, plant height is more variable depending on plant genetics and on the weather of the season. The following table gives some comparative heights for each leaf stage but individual plants may be slightly more or less than the stage given depending on genetics and weather. The standing height is measured from the ground surface to the top of the plant as it stands. Leaf extended refers to the height of the plant with the leaves pulled up to their full height.

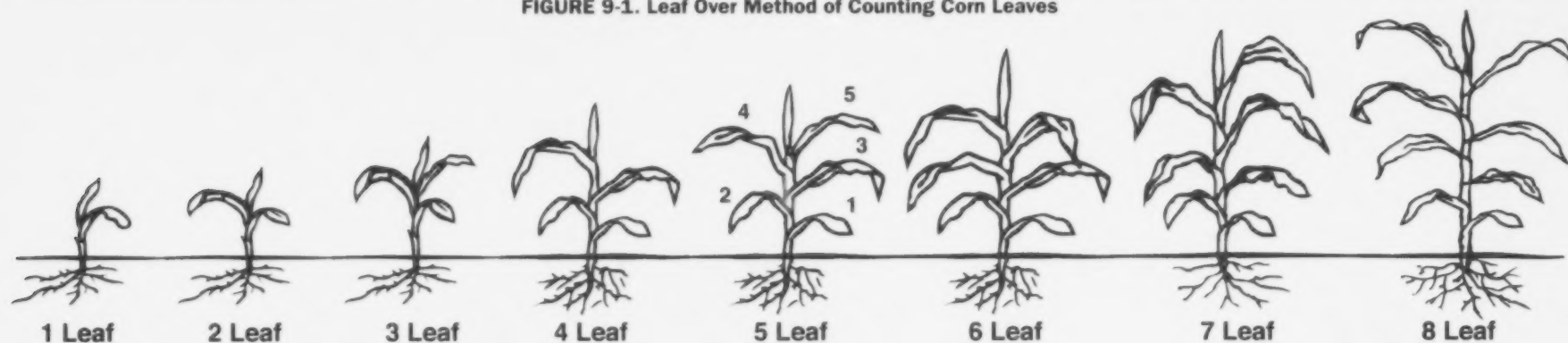
TABLE 9-3. Comparative Growth Stages

Leaf Over ¹	Leaf Collar	Leaf Tip ²	Standing Height (cm)	Leaf Extended (cm)
2	1	3	5–6	5–11
4	3	5–6	9–17	16–25
6	4–5	7–8	18–33	29–46
8	5–6	9–10	36–54	54–77
10	8	12	58–85	86–112
12	10	14–15	99–114	121–149

¹ Number of leaf tips emerged from the whorl.

² Number of leaf whorls emerged from the whorl.

FIGURE 9-1. Leaf Over Method of Counting Corn Leaves



Why is Early Season Weed Control so Important in Corn?

(Source: Eric Page, Clarence Swanton, 2009. Department of Plant Agriculture, University of Guelph)

Weed competition continues to be a major factor limiting agricultural production provincially, nationally and internationally. Over the past 20 years, research studies in the weed science lab at the University of Guelph has focused on describing when and how weed competition reduces corn (*Zea mays* L.) yields in Ontario. These studies have defined the critical period for weed control in corn and have demonstrated that weed competition can reduce grain yield as early 20 days after planting at the 3 leaf stage of corn (Figure 9-1). More importantly, these studies have also demonstrated that yield lost as a result of early season weed competition is never regained, in spite of timely weed removal.

In Ontario, corn yield losses from weed competition can range from 0.3–2.2% per day (after the third leaf tip stage, Figure 9-2). The timing and severity of these yield losses varies from site to site and year to year, which greatly complicates weed control measures. Much of this variability can be attributed to two key factors: (1) the time at which the weeds emerged

relative to the crop, and (2) the density of the weed population. The relative importance of these factors in determining yield losses has been the subject of several studies, including one by Bonic and Swanton (1997) on the competitiveness of barnyard grass (*Echinochloa crus-gali* (L.) P. Beauv) with corn. Interestingly, the results of this study demonstrated that the density of a weed population was far less important in determining crop yield losses than the time at which the weeds emerged (Figure 9-3). For instance, 60 barnyard grass seedlings emerging when the corn was at the 1 leaf stage reduced yield by 12%, whereas if the same number of seedlings emerged when the corn was at the 4 leaf stage the yield loss was only 3%. It is clear from these results that weed emerging at or near the time of crop emergence have the greatest potential to reduce crop yield and thus, should be considered the most important targets of weed control practices.

Our most recent research has focused on understanding why the timing of weed emergence is so important in determining yield losses in corn. Based on the established critical period for weed control and the result of Bonic and Swanton (1997) (Fig 9-3), we know that later emerging weeds often have much less effect on corn yield potential. Furthermore, good agronomic practices

(e.g. seedbed preparation, fertilization, planting depth, etc.) should ensure that crop seedlings have access to abundant resources for the duration of early seedling

FIGURE 9-2. The Effect of Weed Competition on Corn Yield Potential

The data points along the line represent the yield potential of the crop when weeds were controlled at the corresponding days after planting. Adapted from Hall, Swanton and Anderson (1992).

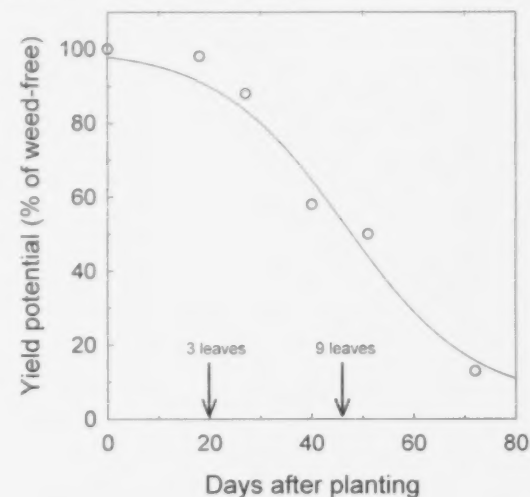
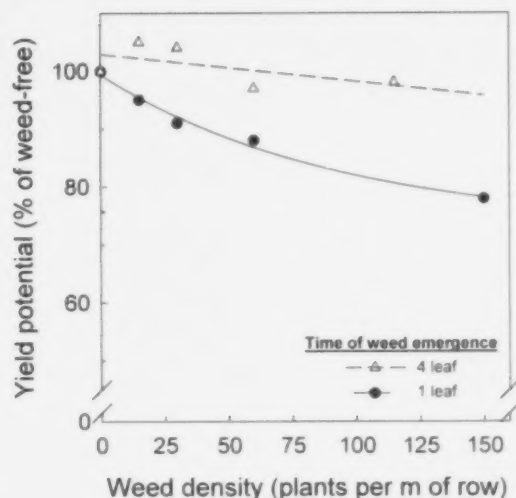


FIGURE 9-3. The Effect of Weed Density and Time of Emergence on Corn Yield Potential

Adapted from Bosnic and Swanton (1997).

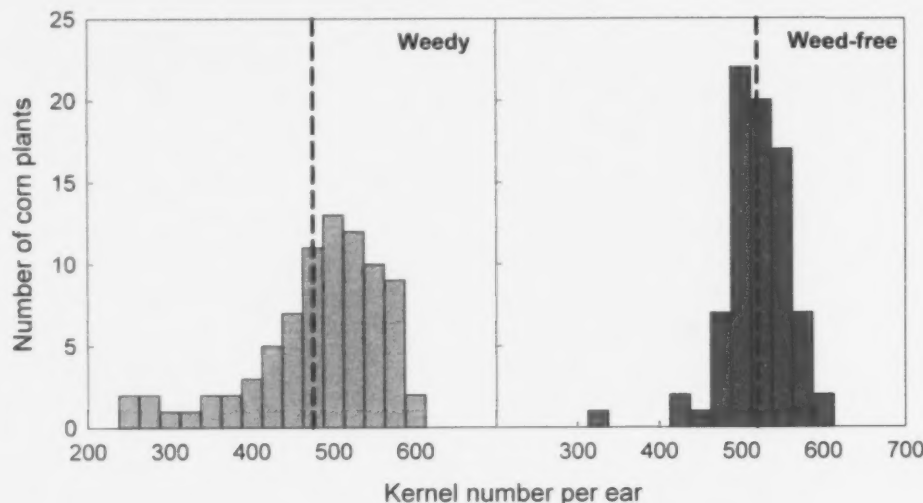


development. How then, if resources are plentiful, do early season crop-weed interactions reduce grain yields?

It is possible that crop-weed competition actually begins before resources become limiting. In fact, it is well established that plants perceive and respond to neighbouring competitors before any shading occurs. This response, called shade avoidance, is based on light signals reflected from the leaves of nearby plants and serves as an early warning system of impending competition. Shade avoidance causes plants to grow taller and put more resources into shoot growth at the expense of developing their root system. This temporary shift in resource allocation may enable plants to overtop their competitor and capture more of the incoming light. In natural ecosystems, shade avoidance provides a competitive advantage and increases the chance of survival to reproduction. Conversely, shade avoidance in

FIGURE 9-4. The Number of Kernels per Ear of Plants in Corn Stands That Developed Under Simulated Weedy or Weed-Free Conditions, Respectively (E.Page unpublished data)

Dashed lines indicate the mean kernel number per ear for each population.



agricultural systems may reduce crop yield potential by increasing plant-to-plant variability within a crop stand.

Stand uniformity has long been regarded as a key component to maximizing crop yield potential. In corn, yield potential is closely associated with kernel number per plant (KNP) and thus, it is not surprisingly that yield losses from early season weed competition are also caused by reductions in KNP. In a recent experiment, we examined whether weed-induced shade avoidance, without direct competition for resources, could explain the yield losses associated with early season weed competition. Indeed, it was clear from the results of this study that shade avoidance alone reduced the mean KNP by 7% and, perhaps more importantly, it doubled the plant-to-plant variability in KNP (Figure 9-4).

We contend that early season weed competition causes yield losses in corn by increasing the plant-to-plant variability in KNP. This effect will persist even after weed removal and will seldom be noticed visually as it occurs without changing the mean size of the plants in the crop stand. Under favourable growing conditions, modest reductions in KNP may be compensated for by increases in kernel weight, such that yield losses are minimized. However, if the crop experiences subsequent stresses (e.g. direct competition for resources, drought, etc.), yield losses may reflect the cumulative effects triggered by shade avoidance and subsequent stresses. We suggest that it is for this reason that weeds emerging with the crop are more competitive than later emerging weeds. Furthermore, the interactions of shade avoidance, direct competition and environmental stresses may account for the variability in yield losses observed from site-to-site and year-to-year.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

CONVENTIONAL CORN (FIELD, SEED AND SWEET)

Preplant Burndown and Residual Control

- Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one-pass" weed management program.
- Refer to Chapter 6, *Preplant & Postharvest Weed Control*, page 77 for preplant application rates for glyphosate and GRAMAXONE.
- It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. atrazine, CONVERGE PRO, PRIMEXTRA II MAGNUM) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.

Soil Applied Grass and Broadleaf Herbicides (Preemergence Timing Only)

PRINCEP NINE-T (90 WG)	1.5–2.5 kg/ha	0.6–1 kg/ac	• These products are listed separately because of their widely differing rate ranges. In both cases the low rates should be used on sandy soils while the higher rates may be used on loams and clays. • Full season annual weed control can be expected except for crabgrass or fall panicum where infestations have built up. • Caution is advised when considering rates beyond 2.0 kg/ha (0.8 kg/ac) as soil residues may be high.
simazine	1.35–2.25 kg/ha		
or SIMADDEX (500 g/L)	3.2–8 L/ha	1.28–3.2 L/ac	
or SIMAZINE 480 (480 g/L)	3.4–8.3 L/ha	1.36–3.32 L/ac	
simazine	1.6–4 kg/ha		

Soil Applied Tank-Mixes (Preemergence Timing Only)

DUAL II MAGNUM (915 g/L)	1.25 L/ha	0.5 L/ac	• Use ONLY on sweet corn. • Make ONLY one application per year. • Apply in a minimum of 150 L water/ha. • Do NOT harvest sweet corn within 50 days of treatment. • Apply by ground equipment ONLY.
plus LOROX L (480 g/L)	0.79–1.56 L/ha	0.32–0.63 L/ac	
plus atrazine (480 g/L)*	2.06–3.19 L/ha	0.83–1.28 L/ac	
s-metolachlor/benoxacor	1.14 kg/ha		
plus linuron	0.38–0.75 kg/ha		
plus atrazine	0.99–1.53 kg/ha		
PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	3–4 L/ha	1.2–1.6 L/ac	• Do NOT use on seed corn or sweet corn. • This tank-mix can be used on light textured soils with OM greater than 1.0%. • Linuron controls triazine resistant lamb's-quarters and redroot pigweed. Fall panicum or velvetleaf may not be controlled for the full season.
plus LOROX L (480 g/L)	0.77–1.56 L/ha	0.31–0.63 L/ac	
s-metolachlor/benoxacor/ atrazine	2.16–2.88 kg/ha		
plus linuron	0.37–0.75 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Soil Applied Broadleaf Herbicides (Preemergence timing only)			
atrazine (480 g/L)	2.1–3.1 L/ha	0.84–1.24 L/ac	• Weeds will normally emerge and die within a few days; atrazine can persist for varying lengths of time; longer under dry, cool weather and coarse textured soils. See tank-mixes for reducing rates and avoiding residues, and for treatments to provide annual grass control. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.
atrazine	1.01–1.49 kg/ha		
atrazine (480 g/L) plus BANVEL II (480 g/L) or ORACLE (480 g/L)	2.1–3.1 L/ha 1.25 L/ha	0.84–1.24 L/ac 0.5 L/ac	• Do NOT use on seed corn or sweet corn. • This treatment should provide good control of triazine resistant broadleaf weeds and velvetleaf. • See notes on atrazine with respect to residues, on page 113. • See precautions for BANVEL II or ORACLE applied alone. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter.
atrazine plus dicamba	1.01–1.49 kg/ha 0.6 kg/ha		
BANVEL II (480 g/L) or ORACLE (480 g/L)	1.25 L/ha	0.5 L/ac	• If corn seed is less than 4 cm below the soil surface, delay application of BANVEL II until the spike stage of corn. • Apply to medium to fine textured soils containing more than 2.5% organic matter. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter. • Do NOT incorporate.
dicamba	0.6 kg/ha		
CALLISTO (480 g/L) plus AATREX LIQUID (480 g/L)	0.3 L/ha 2.1–3.1 L/ha	0.12 L/ac 0.85–1.25 L/ac	• Apply PRE to field, seed or sweet corn.
mesotrione plus atrazine	0.140 kg/ha 1.0–1.49 kg/ha		
MARKSMAN (393 g/L) or PROPERO (393 g/L)	3.7–4.5 L/ha	1.5–1.8 L/ac	• Do NOT use on seed corn or sweet corn. • See notes on atrazine with respect to residues, page 113. • See precautions for BANVEL II applied alone. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter.
dicamba/atrazine	1.5–1.8 kg/ha		
Soil Applied and Early Postemergence Grass Herbicides			
DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ac	• Apply PPI, PRE. • Apply POST (up to 3 leaf corn) on field corn only. • For PPI timing, set incorporation equipment to work soil no deeper than 10 cm. • Improved control of yellow nutsedge is obtained when DUAL II MAGNUM is applied PPI. • Grassy weeds beyond the 2 leaf stage will not be controlled. • Optimal control of nightshade is obtained when DUAL II MAGNUM is applied PRE. • Do NOT use on muck, peat, or high organic matter soils. • See tank-mixes for treatments to provide annual broadleaf control or follow with sequential postemergence broadleaf herbicide. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.
s-metolachlor/benoxacor	1.14–1.6 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
FRONTIER MAX (720 g/L)	756–963 mL/ha	302–385 mL/ac	• Apply PPI or PRE to seed, sweet and field corn. • Apply POST (up to 3 leaf corn) on field corn only. • For PPI timing, set incorporation equipment to work soil no deeper than 10 cm. • Improved control of yellow nutsedge is obtained when FRONTIER MAX is applied PPI at the highest rate. • Sensitive weeds beyond the 2 leaf stage will not be controlled. • Apply higher rates on fine textured or high organic matter soils or when targeting night-shade, nutsedge and pigweed. • Do NOT use on muck, peat, or high organic matter soils. • See tank-mixes for treatments to provide annual broadleaf control or follow with sequential postemergence broadleaf herbicide. • Maximum use rate of FRONTIER MAX for seed corn is 756 mL/ha (302 mL/ac). • Consult the seed corn company for information on the tolerance of seed corn inbred lines prior to the use of FRONTIER MAX herbicide.
dimethenamid	544–693 g/ha		
OR IF USING:			
FRONTIER (900 g/L)	1.1–1.4 L/ha	0.44–0.56 L/ac	
dimethenamid	1–1.25 kg/ha		

Preemergence and Early Postemergence Grass and Broadleaf Herbicides

BATTALION ¹			• Apply PRE. • See precautions for BANVEL II or ORACLE alone, on this page. • Do NOT incorporate. • BATTALION can be applied with 28% UAN as a carrier (PRE only). • For suppression of quackgrass, apply BATTALION at the 1–6 leaf stage of quackgrass. • Do NOT use on seed corn or sweet corn. • BATTALION is a co-pack of ELIM EP, DUAL II MAGNUM and BANVEL II.
(ELIM EP (25 DF) +	60 g/ha +	24 g /ac +	
DUAL II MAGNUM (915 g/L)	0.75 L/ha +	0.3 L/ac +	
+BANVEL II (480 g/L))	0.75 L/ha	0.3 L/ac	
rimisulfuron +	15 g/ha +		
s-metolachlor/benoxacor +	684 g/ha +		• Do NOT use on seed corn or sweet corn. • Apply POST from the spike to 3 leaf stage of field corn. • See precautions for BANVEL II alone, page 124. • Refer to individual product labels for use precautions. • For suppression of quackgrass, apply BATTALION at the 1–6 leaf stage of quackgrass. • BATTALION is a co-pack of ELIM EP, DUAL II MAGNUM and BANVEL II.
dicamba	360 g/ha		
BATTALION ¹			
ELIM EP (25 DF) +	50 g/ha +	20 g/ac +	
DUAL II MAGNUM (915 g/L) +	0.625 L/ha +	0.25 L/ac +	
BANVEL II (480 g/L)	0.625 L/ha	0.25 L/ac	• For suppression of quackgrass, apply BATTALION at the 1–6 leaf stage of quackgrass. • BATTALION is a co-pack of ELIM EP, DUAL II MAGNUM and BANVEL II.
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	
rimisulfuron +	12.5 g/ha +		
s-metolachlor/benoxacor +	573 g/ha +		
dicamba	300 g/ha +		
plus non-ionic surfactant	0.2% v/v		

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
CONVERGE XT ¹ CONVERGE FLEXX (240 g/L) + CONVERGE 480 (480 g/L)	330–440 mL/ha + 1.67–2.21 L/ha	132–174 mL/ac + 0.67–0.88 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Do NOT incorporate treatments prior to planting. • Use the higher application rates for control of fall panicum and proso millet. • CONVERGE XT is a co-pack of CONVERGE FLEXX and CONVERGE 480. • Do NOT use CONVERGE XT on sands, loamy sands and/or soils with less than 2% organic matter. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.
isoxaflutole + atrazine	79–105 g/ha + 0.8–1.063 kg/ha		
PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	3–4 L/ha	1.2–1.6 L/ac	• Apply PPI, PRE or POST up to the 3 leaf stage of corn. • Use the higher rate where annual grass build up or nutsedge infestation is evident. • Grassy weeds beyond the 2 leaf stage will not be controlled. • The equivalent rate of PRIMEXTRA II MAGNUM can be achieved by adding DUAL II MAGNUM at 0.5–0.7 L/ac with AATREX 480 at 0.84–1.24 L/ac. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.
s-metolachlor/benoxacor/ atrazine	2.16–2.88 kg/ha		
Soil Applied and Early Postemergence Tank-Mixes (For Control of Grass and Broadleaf Weeds)			
DUAL II MAGNUM (915 g/L) plus BANVEL II (480 g/L) or ORACLE (480 g/L)	1.25–1.75 L/ha 1.25 L/ha	0.5–0.7 L/ac 0.5 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Use higher rates of DUAL II MAGNUM on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. • Grassy weeds beyond the 2 leaf stage will not be controlled. • See precautions for BANVEL II or ORACLE alone, page 124. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter.
s-metolachlor/benoxacor plus dicamba	1.14–1.6 kg/ha 0.6 kg/ha		
DUAL II MAGNUM (915 g/L) plus BANVEL II (480 g/L) or ORACLE (480 g/L) plus atrazine (480 g/L)*	1.25–1.75 L/ha 1.25 L/ha 2.1–3.1 L/ha	0.5–0.7 L/ac 0.5 L/ac 0.84–1.24 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Use higher rates of DUAL II MAGNUM on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. • Grassy weeds beyond the 2 leaf stage will not be controlled. • See precautions for BANVEL II or ORACLE alone, page 124. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter.
s-metolachlor/benoxacor plus dicamba plus atrazine	1.14–1.6 kg/ha 0.6 kg/ha 1.01–1.49 kg/ha		

¹ Indicates product sold as a co-pack.

* Numerous products exist, refer to Table 4-1. *Herbicides Used in Ontario*, page 23 for a complete list of available products.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
DUAL II MAGNUM (915 g/L) plus CALLISTO (480 g/L) plus AATREX LIQUID (480 g/L)	1.25–1.75 L/ha 0.3 L/ha 2.1–3.1 L/ha	0.5–0.7 L/ac 0.12 L/ac 0.85–1.25 L/ac	• Apply PRE to field, seed and sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn only. • Use high rates for heavy grass infestations. • Grassy weeds beyond the 2 leaf stage will not be controlled. • Do NOT apply to corn treated with an organophosphorous insecticide.
s-metolachlor/benoxacor plus mesotrione plus atrazine	1.14–1.60 kg/ha 0.140 kg/ha 1.0–1.49 kg/ha		
DUAL II MAGNUM (915 g/L) plus MARKSMAN (393 g/L) or PROPERO (393 g/L)	1.25–1.75 L/ha 3.7–4.5 L/ha	0.5–0.7 L/ac 1.5–1.8 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Use higher rates on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. • Grassy weeds beyond the 2 leaf stage will not be controlled. • See precautions for BANVEL II alone, page 124. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter.
s-metolachlor/benoxacor plus dicamba/atrazine	1.14–1.6 kg/ha 1.48–1.8 kg/ha		
CONVERGE FLEXX plus atrazine (480 g/L)	330–440 mL/ha + 1.67–2.21 L/ha	132–174 mL/ac + 0.67–0.88 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Do NOT incorporate treatments prior to planting. • Use the higher application rates for control of fall panicum and proso millet. • Do NOT use CONVERGE FLEXX on sands, loamy sands and/or soils with less than 2% organic matter.
isoxaflutole plus atrazine	79–105 g/ha + 0.8–1.063 kg/ha		
FRONTIER MAX (720 g/L) plus atrazine (480 g/L)*	756–963 mL/ha 2.08–3.19 L/ha	302–385 mL/ac 0.832–1.28 L/ac	• Apply PREPLANT, PPI, PRE or POST up to the 3 leaf stage of corn. • Use the higher rate of FRONTIER MAX for heavier weed populations. Control of non-emerged triazine resistant weeds will be limited to pigweed. • Grassy weeds beyond the 2 leaf stage will not be controlled. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • If using FRONTIER (900 g/L) apply at a rate of 0.44–0.56 L/ac.
dimethenamid plus atrazine	544–693 g/ha 1–1.53 kg/ha		
FRONTIER MAX (720 g/L) plus BANVEL II (480 g/L)	756–963 mL/ha 1.25 L/ha	302–385 mL/ac 0.5 L/ac	• Do NOT use on seed corn, popcorn or sweet corn. • Apply PREPLANT, PRE or POST up to the 3 leaf stage of field corn. • Use the higher rate of FRONTIER MAX for heavier weed populations. For improved burndown control, the addition of glyphosate may be required. • Grassy weeds beyond the 2 leaf stage will not be controlled. • See precautions for BANVEL II applied alone, page 124. • If using FRONTIER (900 g/L) apply at a rate of 0.44–0.56 L/ac.
dimethenamid plus dicamba	544–693 g/ha 0.6 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
FRONTIER MAX (720 g/L) plus MARKSMAN (393 g/L) <i>dimethenamid</i> <i>plus dicamba/ atrazine</i>	756–963 mL/ha 4.5 L/ha 544–693 g/ha 1.8 kg/ha	302–385 mL/ac 1.8 L/ac	• Do NOT use on seed or sweet corn. • Apply PREPLANT, PRE or POST up to the 3 leaf stage of field corn. • Use the higher rate of FRONTIER MAX for heavier weed populations. For improved burndown control, adding glyphosate may be required. • Grassy weeds beyond the 2 leaf stage will not be controlled. • See precautions for BANVEL II or ORACLE applied alone, page 124. • If using FRONTIER (900 g/L) apply at a rate of 0.44–0.56 L/ac.
PRIMEXTRA II MAGNUM (1:0.8) 720 g/L) plus CALLISTO (480 g/L) <i>s-metolachlor/benoxacor/atrazine</i> <i>plus mesotrione</i>	3–4 L/ha 0.3 L/ha 2.16–2.88 kg/ha 0.140 kg/ha	1.2–1.6 L/ac 0.12 L/ac	• Apply PRE to seed and sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Use high rates for heavy grass infestations. • Grassy weeds beyond the 2 leaf stage will not be controlled. • Do NOT apply to corn treated with an organophosphorous insecticide.
PRIMEXTRA II MAGNUM (1:0.8) 720 g/L) plus BANVEL II (480 g/L) or ORACLE (480 g/L) <i>s-metolachlor/benoxacor/</i> <i>atrazine</i> <i>plus dicamba</i>	3–4 L/ha 1.25 L/ha 2.16–2.88 kg/ha 0.6 kg/ha	1.2–1.6 L/ac 0.5 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • Use higher rates on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. • Grassy weeds beyond the 2 leaf stage will not be controlled. • See precautions for BANVEL II or ORACLE alone, page 124. • Do NOT apply to coarse (sand) textured soils with less than 2% organic matter.
PROWL 400 (400 g/L) <i>pendimethalin</i>	4.2 L/ha 1.68 kg/ha	1.68 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • PROWL alone will not control emerged weeds. Tank-mixing or use of a sequential herbicide program to achieve broad spectrum control is recommended. Plant corn at least 4 cm deep and ensure good seed coverage. PROWL may be applied in water or liquid fertilizer (rate of 200 L liquid fertilizer/ha (80 L liquid fertilizer/ac)). Conduct a liquid fertilizer compatibility test with any of the registered PROWL tank-mix combinations. If there is no rain within 7 days, rotary hoeing or shallow cultivation is required.
PROWL 400 (400 g/L) plus atrazine (480 g/L)* <i>pendimethalin</i> <i>plus atrazine</i>	4.2 L/ha 3.19 L/ha 1.68 kg/ha 1.53 kg/ha	1.68 L/ac 1.28 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • See precautions for PROWL alone, on this page.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
PROWL 400 (400 g/L) plus BANVEL II (480 g/L) or ORACLE (480 g/L)	4.2 L/ha 1.25 L/ha	1.68 L/ac 0.5 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • See precautions for PROWL alone, page 122, and BANVEL II or ORACLE alone, page 124.
pendimethalin plus dicamba	1.68 kg/ha 0.6 kg/ha		
PROWL 400 (400 g/L) plus MARKSMAN (393 g/L)	4.2 L/ha 3.7–4.5 L/ha	1.68 L/ac 1.5–1.8 L/ac	• Do NOT use on seed corn or sweet corn. • Apply PRE or POST up to the 3 leaf stage of field corn. • See precautions for PROWL alone, page 122, and BANVEL II or ORACLE alone, page 124.
pendimethalin plus dicamba/atrazine	1.68 kg/ha 1.48–1.8 kg/ha		
Postemergence Grass Herbicides			
ACCENT (75 DF) plus non-ionic surfactant plus liquid urea ammonium nitrate (UAN)	33 g/ha 2 L/1,000 L 5 L/ha	13 g/ac 2 L/1,000 L 2 L/ac	• Do NOT add liquid urea ammonium nitrate (UAN) when applying ACCENT to seed or sweet corn. • For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety. • Adding UAN will give improved control of yellow foxtail in Field Corn. • Adapt oil concentrate (1% v/v), Merge or Sure-Mix (0.5% v/v) can be used in place of a non-ionic surfactant (Field Corn only). • Always add water soluble packages to clean water with the agitator running. Corn should be within the 1–8 leaf stage of growth. Apply ACCENT when annual grasses are in the 1–6 leaf stage and quackgrass is in the 3–6 leaf stage.
nicosulfuron plus non-ionic surfactant plus liquid urea ammonium	25 g/ha 0.2% v/v 5 L/ha		
ULTIM ((1:1) 75 DF) plus non-ionic surfactant	33 g/ha 2 L/1,000 L	13g/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Always add water soluble packages to clean water with the agitator running. Corn should be within the 1–6 leaf stage. Apply ULTIM when annual grasses are in the 1–6 leaf stage, and quackgrass is in the 3–6 leaf stage. • ONLY apply ULTIM when air temperatures in the 24 hours before and after application range between 5°C and 28°C.
nicosulfuron/rimsulfuron plus non-ionic surfactant	25 g/ha 0.2% v/v		
Postemergence Broadleaf Herbicides and Tank-Mixes (For Broadleaf Weed Control)			
2,4-D (470 g/L)	0.6–1.2 L/ha	0.24–0.48 L/ac	• Do NOT use on seed corn or sweet corn. • Apply as an overall spray until corn is 15 cm high (leaf extended); thereafter, use drop nozzles. Use amine formulation. • See special notes on postemergence use of 2,4-D and related hormone chemicals, page 113. • Do NOT add oil or surfactant.
2,4-D*	0.28–0.56 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
atrazine (480 g/L) plus oil	2.1–3.1 L/ha 10–17 L/ha	0.84–1.24 L/ac 4–6.8 L/ac	• For increased activity and extended period of activity, apply in an oil water emulsion of 10–17 L/ha (4–6.8 L/ac) of emulsifiable light mineral oil and 150–200 L/ha water (60–80 L/ac). Apply when most weeds have emerged. The low rate can be used successfully with later cultivation.
atrazine plus oil	1.01–1.49 kg/ha 10–17 L/ha		
atrazine (480 g/L) plus BUCTRIL M ((1:1) 560 g/L) or BADGE ((1:1) 450 g/L) or LOGIC M ((1:1) 450 g/L) or MEXTROL (1:1) (450 g/L)	2.29–3.1 L/ha 1 L/ha 1.25 L/ha	0.96–1.24 L/ac 0.4 L/ac 0.5 L/ac	• Do NOT use on seed corn or sweet corn. • Apply from the 4–6 leaf stage of corn but injury may occur if applied after the 6 leaf stage. • Controls a wider spectrum of broadleaf weeds than bromoxynil/MCPA alone; larger velvetleaf will be controlled. • Do NOT add oil or surfactant. • Do NOT use formulated atrazine/oil products in this tank-mixture.
atrazine plus bromoxynil/ MCPA	1.1–1.49 kg/ha 0.56 kg/ha		
atrazine (480 g/L) plus BANVEL II (480 g/L) or ORACLE (480 g/L)	2.1–3.1 L/ha 0.6 L/ha	0.84–1.24 L/ac 0.24 L/ac	• Do NOT use on seed corn or sweet corn. • This treatment will provide good to excellent control of broadleaf weeds including those triazine resistant and velvetleaf. Use the higher rate for residual control. • See special notes for corn regarding dicamba applications, page 113 and precautions for BANVEL II or ORACLE alone POST, page 124.
atrazine plus dicamba	1.01–1.49 kg/ha 0.288 kg/ha		
BANVEL II (480 g/L) or ORACLE (480 g/L)	0.6–1.25 L/ha	0.24–0.5 L/ac	• Do NOT use on seed corn or sweet corn. • Application of the lower rate can be made up to 20 cm standing corn. Use drop pipes when corn is 20–50 cm tall. The 0.6 kg/ha rate commonly referred to as the overlay treatment is particularly effective in controlling velvetleaf and providing extended residual control of other late germinating deep rooted broadleaf annuals and can be applied from the spike stage to the 5 leaf stage (13 cm standing corn). • See special notes on postemergence use of dicamba and related hormone chemicals, page 113. • Do NOT use dicamba if temperature exceeds 25°C at the time of application, or if high humidity is expected, due to the possibility of dicamba volatilizing and injury to susceptible crops nearby. • Do NOT add oil or surfactant.
dicamba	0.288–0.6 kg/ha		
BANVEL II (480 g/L) or ORACLE (480 g/L) plus 2,4-D (470 g/L)*	0.29 L/ha 0.85 L/ha	0.12 L/ac 0.34 L/ac	• Do NOT use on seed corn or sweet corn. • Application can be made up to 10 cm standing corn. Use drop pipes when corn is 10–50 cm tall. Use amine formulation of 2,4-D. • See special notes on postemergence use of dicamba and 2,4-D and related hormone chemicals, page 113. • Do NOT add oil or surfactant.
dicamba plus 2,4-D	0.14 kg/ha 0.4 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
BASAGRAN FORTÉ (480 g/L)	1.75–2.25 L/ha	0.7–0.9 L/ac	• Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/ac) (0.84 kg active/ha) applied 10 days apart. • Cool weather or drought may delay control.
bentazon plus oil concentrate	0.84–1.08 kg/ha 2 L/ha		
BUCTRIL M ((1:1) 560 g/L) or BADGE ((1:1) 450 g/L) or LOGIC M ((1:1) 450 g/L) or MEXTROL (1:1) 450 g/L)	1 L/ha 1.25 L/ha	0.4 L/ha 0.5 L/ha	• Do NOT use on seed corn or sweet corn. • Apply from the 4–6 leaf stage of corn but injury may occur if applied after the 6 leaf stage. • Controls most annual broadleaf weeds up to the 4 leaf stage (lamb's-quarters and mustards to 8 leaf stage). • Use in preference to PARDNER or KORIL when wild mustard is a particular problem.
bromoxynil/ MCPA	0.558 kg/ha		
CALLISTO (480 g/L) plus AATREX LIQUID (480 g/L) plus non-ionic surfactant	0.21 L/ha 0.58 L/ha 2 L/1,000 L	0.085 L/ac 0.235 L/ac 2 L/1,000 L	• Apply from the 3–8 leaf stage of field corn. • Apply from the 3–6 leaf stage of seed or sweet corn. • Do NOT apply to Delmonte 2038 sweet corn. • Do NOT harvest sweet corn within 50 days of treatment. • Seed corn inbred and sweet corn varieties vary in their tolerance to CALLISTO, consult your seed supplier for more information. • Apply in 100–200 L/ha of water. • Do NOT apply to corn treated with an organophosphorous insecticide.
mesotrione plus atrazine plus non-ionic surfactant	0.1 kg/ha 0.28 kg/ha 0.2% v/v		
DISTINCT (70 WG) plus non-ionic surfactant plus liquid urea ammonium nitrate (UAN)	0.285 kg/ha 2.5 L/1,000 L 12.5 L/1,000 L	0.115 kg/ac 2.5 L/1,000 L 12.5 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply to actively growing weeds when corn is in the 2–6 leaf stage. • Apply when temperatures above 4°C are predicted for the 24 hours before and after application.
diffufenzopyr/dicamba plus non-ionic surfactant plus liquid urea ammonium	0.2 kg/ha 0.25% v/v 1.25% v/v		
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L)	1.75–2.25 L/ha	0.7–0.9 L/ac	• Do NOT use on seed corn or sweet corn. • See special notes on postemergence use of 2,4-DB and related hormone chemicals, page 113. • Note: The maximum label rate for EMBUTOX 625 is 2.25 L/ha (0.9 L/ac) of product. • Do NOT add oil or surfactant.
2,4-DB	1.1–1.5 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69)
IMPACT (336g/L) plus atrazine (480g/L)* plus MERGE plus liquid urea ammonium nitrate (UAN)	0.037 L/ha 1.04 L/ha 5 L/1,000 L 12.5 L/1,000 L	15 ml/ac 0.42 L/ac 5 L/1,000 L 12.5 L/1,000 L	• Apply to emerged grassy (up to 4 leaf) and broadleaf (up to 8 leaf) weeds. • Apply between the spike and 7 leaf stage of seed, sweet and field corn. • For seed and sweet corn , ASSIST should be used instead of MERGE at a rate of 12.5 L/1,000 L. The use of MERGE will increase the risk of crop injury to seed and sweet corn.
topramezone plus atrazine plus adjuvant plus liquid urea ammonium	12.5 g/ha 0.5 kg/ha 0.5% v/v 1.25% v/v		
LADDOK ((1:1) 400 g/L) plus ASSIST	2–4 L/ha 2 L/ha	0.8–1.6 L/ac 0.8 L/ac	• The recommended rate of 1.2–1.6 kg/ha of LADDOK (3–4 L/ha (1.2–1.6 L/ac)). • LADDOK may be reduced to 0.8–1 kg/ha (2–2.5 L/ha (0.8–1 L/ac)). • If FRONTIER or DUAL II MAGNUM has been applied at the recommended rate for preemergence grass control. Use LADDOK at 3–4 L/ha (1.2–1.6 L/ac) for nutsedge control; repeat 7–10 days if necessary.
bentazon/ atrazine plus oil concentrate	0.8–1.6 kg/ha 2 L/ha		
MARKSMAN (393 g/L) or PROPERO (393 g/L)	3.7–4.5 L/ha	1.5–1.8 L/ac	• Do NOT use on seed corn or sweet corn. • Application can be made up to 13 cm standing corn (5 leaf). Use the lower rate on coarse textured soils and the higher rate on medium to fine textured soils. • See special notes on postemergence use of dicamba and related hormone chemicals.
dicamba/atrazine	1.48–1.8 kg/ha		
MCPA AMINE (500 g/L)* MCPA	0.76–1.26 L/ha 0.38–0.63 kg/ha	0.3–0.5 L/ac	• Do NOT use on seed corn or sweet corn. • Treat before the corn reaches 15 cm tall (leaf extended). • Use the lower rate for small, actively growing weeds and the higher rate for larger weeds or under adverse weather conditions. • Top growth control of fully developed HORSETAIL (15–25 cm) can be achieved with 1 L/ha (0.4 L/ac) of product.
PARDNER (280 g/L) or KORIL, BROTEX (235 g/L)	1–1.2 L/ha 1.2–1.4 L/ha	0.4–0.48 L/ac 0.48–0.56 L/ac	• Controls most annual broadleaf weeds, including triazine resistant species at the 1–4 leaf stage. • PARDNER and KORIL are contact herbicides and are non volatile. • Do NOT use BROTEX on seed or sweet corn.
bromoxynil	0.28–0.34 kg/ha		
PARDNER (280 g/L) or KORIL, BROTEX (235 g/L) plus BANVEL II (480 g/L)	1 L/ha 1.2 L/ha 0.3 L/ha	0.4 L/ac 0.48 L/ac 0.12 L/ac	• Do NOT use on seed corn or sweet corn. • Apply when the corn is in the 4–6 leaf stage as an overall treatment and up to 50 cm standing corn, using drop pipes. • Controls most annual broadleaf weeds including triazine resistant lamb's-quarters, pigweed and ragweed up to the 6 leaf stage. • See special notes on postemergence use of dicamba and precautions for BANVEL II alone POST, page 124.
bromoxynil plus dicamba	0.28 kg/ha 0.144 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
PEAKPLUS ¹			• Do NOT apply to sweet corn.
PEAK (75 WG)	13.3 g/ha	5.3 g/ac	• Apply when the corn is in the 2–7 leaf stage.
+ BANVEL II (480 g/L)	+ 0.3 L/ha	+ 0.12 L/ac	• Controls most annual broadleaf weeds including triazine resistant lamb's-quarters and pig-weed up to the 6 leaf stage; cocklebur and velvetleaf up to the 6 leaf stage; and ragweed up to the 8 leaf stage.
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	• Do NOT apply to corn treated with organophosphorus insecticides.
prosulfuron + dicamba	10 g/ha + 0.14 kg/ha		• PEAKPLUS is a co-pack of PEAK 75WG and BANVEL II.
plus non-ionic surfactant	0.2% v/v		
SHOTGUN (390 g/L)	2.4–3.59 L/ha	0.96–1.44 L/ac	• Do NOT use on seed corn or sweet corn.
atrazine/2,4-D	0.936–1.404 kg/ha		• Apply as an overall spray from the spike to the 4 leaf stage of corn.
TROPOTOX PLUS (400 g/L)	2.75–4.25 L/ha	1.1–1.7 L/ac	• Do NOT add oil or surfactant.
or CLOVITOX PLUS (400 g/L)			• Do NOT use on seed corn or sweet corn.
or TOPSIDE (400 g/L)			• Apply when corn is 30–60 cm high, using drop pipes. Some control of field horsetail may be obtained with the higher rates of MCPB/MCPA.
MCPB/MCPA (15:1)	1.1–1.7 kg/ha		• See special notes on postemergence use of MCPB/MCPA and related hormone chemicals, page 113.
			• Do NOT add oil or surfactant.
Postemergence Tank-Mixes (For Control of Grass and Broadleaf Weeds)			
ACCENT (75 DF)	33 g/ha	13 g/ac	• See precautions for ACCENT, page 123 and BANVEL II or ORACLE, page 124.
plus BANVEL II (480 g/L)	0.6 L/ha	0.24 L/ac	• Do NOT apply to corn beyond the 6 leaf stage.
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	
nicosulfuron	25 g/ha		
plus dicamba	0.288 kg/ha		
plus non-ionic surfactant	0.2% v/v		
ACCENT (75 DF)	33 g/ha	13 g/ac	• Do NOT use on seed corn or sweet corn.
plus CALLISTO (480 g/L)	0.21 L/ha	0.085 L/ac	• Apply from the 3–8 leaf stage of corn.
plus AATREX LIQUID (480 g/L)	0.58 L/ha	0.235 L/ac	• Apply in 100–200 L/ha of water.
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	• See precautions for ACCENT, page 123 and CALLISTO plus atrazine, page 125.
nicosulfuron	25 g/ha		
plus mesotrione	0.1 kg/ha		
plus atrazine	0.28 kg/ha		
plus non-ionic surfactant	0.2% v/v		

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
ACCENT TOTAL ¹			• Do NOT use on seed corn or sweet corn.
ACCENT (75 DF) +	33 g/ha +	13 g/ac	• Apply to active growth stage of seedling broadleaf weeds (less than 5 cm tall).
DISTINCT (70 WG)	0.285 kg/ha	0.115 kg/ac	• Apply to annual grasses in the 1–6 leaf stage and to quackgrass in the 3–6 leaf stage (10–20 cm).
plus non-ionic surfactant	2.5 L/1,000 L	2.5 L/1,000 L	• Apply when corn is in the 2–8 leaf stage.
plus liquid urea ammonium nitrate (UAN)	5 L/ha	2 L/ac	• ACCENT TOTAL is co-pack of ACCENT and DISTINCT.
			• See precautions for ACCENT, page 123 and DISTINCT, page 125.
<i>nicosulfuron +</i>	25 g/ha +		
<i>diflufenzopyr/dicamba</i>	0.2 kg/ha		
<i>plus non-ionic surfactant</i>	0.2% v/v		
<i>plus urea ammonium nitrate</i>	5 L/ha		
ACCENT (75 DF) plus	33 g/ha	13 g/ac	• See precautions for ACCENT, page 123 and MARKSMAN, page 126.
MARKSMAN (393 g/L)	2.5 L/ha	1 L/ac	• Do NOT apply to corn beyond the 6 leaf stage.
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	
<i>nicosulfuron plus</i>	25 g/ha		
<i>dicamba/ atrazine</i>	1 kg/ha		
<i>plus non-ionic surfactant</i>	0.2% v/v		
ACCENT (75 DF)	33 g/ha	13 g/ac	• Use only when the corn is between the 4 and 8 leaf stage.
plus PARDNER (280 g/L)	1 L/ha	0.4 L/ac	• See precautions for ACCENT, page 123 and PARDNER, page 126.
or KORIL, BROTEX (235 g/L)	1.2 L/ha	0.5 L/ac	
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	
<i>nicosulfuron</i>	25 g/ha		
<i>plus bromoxynil</i>	0.28 kg/ha		
<i>plus non-ionic surfactant</i>	0.2% v/v		
ACCENT 1-PASS ¹			• Do NOT use on seed corn or sweet corn.
ACCENT (75 DF) +	33 g/ha +	13.3 g/ac +	• Apply when the corn is in the 2–7 leaf stage.
PEAKPLUS ¹ (PEAK (75 WG)	13.3 g/ha	5.3 g/ac	• Do NOT apply to corn treated with organophosphorus insecticides.
+ BANVEL II (480 g/L))	+ 0.3 L/ha	+ 0.12 L/ac	• ACCENT 1-PASS is a co-pack of ACCENT and PEAKPLUS.
plus non-ionic surfactant	2 L/1,000 L	2 L/1,000 L	• To control eastern black nightshade at the cotyledon to 6 leaf stage, add atrazine (480 g/L) at a rate of 1.04 L/ha (0.42 L/ac).
<i>nicosulfuron +</i>	25 g/ha +		
<i>prosulfuron + dicamba</i>	10 g/ha + 0.14 kg/ha		
<i>plus non-ionic surfactant</i>	0.2% v/v		

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
ACCENT (75 DF) plus SHOTGUN (390 g/L) plus non-ionic surfactant	33 g/ha 2.4–3.6 L/ha 2 L/1,000 L	13 g/ac 0.96–1.44 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply as an overall spray from 1–4 leaf stage of corn or 1–6 leaf stage of grasses. • See precautions for ACCENT, page 123 and SHOTGUN, page 127.
<i>nicosulfuron plus atrazine/2,4-D plus non-ionic surfactant</i>	25 g/ha 0.94–1.4 kg/ha 0.2% v/v		
IMPACT (336 g/L) plus FRONTIER MAX (720 g/L) plus atrazine (480 g/L)* plus MERGE plus liquid urea ammonium nitrate (UAN)	37 mL/ha 756 mL/ha 1.04 L/ha 5 L/1,000 L 12.5 L/1,000 L	15 mL/ac 302 mL/ac 0.42 L/ac 5 L/1,000 L 12.5 L/1,000 L	• Do NOT use on seed or sweet corn • Apply POST up to 4 leaf grassy weeds and up to 8 leaf broadleaf weeds. • Apply between the spike and 3 leaf stage of corn. • The addition of FRONTIER MAX provides residual grassy weed control. • If using FRONTIER (900 g/L) apply at a rate of 0.45 L/ac
<i>topramezone plus dimethenamid plus atrazine</i>	0.0125 kg/ha 1.0 kg/ha 0.5 kg/ha		
OPTION 1.2.3. OPTION 2.25 OD (22.5 g/L) + DEFINE DF (60%) plus atrazine (480 g/L)* plus liquid urea ammonium nitrate (UAN)	0.67 L/ha 750 g/ha 1.75 L/ha 2.5 L/ha	0.27 L/ac 304 g/ac 0.71 L/ac 1.0 L/ac	• Apply at the 1–3 leaf stage of corn. • Atrazine and UAN (28%) are required tank-mix partners and are to be purchased separately. • Will not provide control of un-emerged triazine resistant lamb's-quarters.
<i>foramsulfuron + flufenacet + atrazine plus UAN</i>	15 g/ha 450 g/ha 840 g/ha 2.5 L/ha		
OPTION 2.25 OD (22.5 g/L) plus AATREX 480 (480 g/L) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 1.75–2.33 L/ha 2.5 L/ha	0.63 L/ac 0.7–0.93 L/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 8 leaf stage of corn.
<i>foramsulfuron plus atrazine plus liquid urea ammonium</i>	35 g/ha 0.84–1.12 kg/ha 2.5 L/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
OPTION 2.25 OD (22.5 g/L) plus BANVEL II (480 g/L) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 0.3 L/ha 2.5 L/ha	0.63 L/ac 0.12 L/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 8 leaf stage of corn.
<i>foramsulfuron</i> <i>plus dicamba</i> <i>plus liquid urea ammonium</i>	35 g/ha 0.144 kg/ha 2.5 L/ha		
OPTION 2.25 OD (22.5 g/L) plus CALLISTO (480 g/L) plus AATREX LIQUID (480 g/L) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 0.21 L/ha 0.58 L/ha 2.5 L/ha	0.63 L/ac 0.085 L/ac 0.235 L/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 8 leaf stage of corn. • Apply in 175 L/ha (70 L/ac) of water.
<i>foramsulfuron</i> <i>plus mesotrione</i> <i>plus atrazine</i> <i>plus liquid urea ammonium</i>	35 g/ha 0.1 kg/ha 0.28 L/ha 2.5 L/ha		
OPTION 2.25 OD (22.5 g/L) plus DISTINCT (70 WG) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 0.285 kg/ha 2.5 L/ha	0.63 L/ac 0.115 kg/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 6 leaf stage of corn.
<i>foramsulfuron</i> <i>plus diflufenzopyr/dicamba</i> <i>plus UAN</i>	35 g/ha 0.2 kg/ha 2.5 L/ha		
OPTION 2.25 OD (22.5 g/L) MARKSMAN (393 g/L) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 2.5 L/ha 2.5 L/ha	0.63 L/ac 1 L/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 5 leaf stage of corn.
<i>foramsulfuron</i> <i>plus dicamba/atrazine</i> <i>plus UAN</i>	35 g/ha 1 kg/ha 2.5 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
OPTION 2.25 OD (22.5 g/L) plus PARDNER (280 g/L) or KORIL (235 g/L) plus AATREX 480 (480 g/L) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 0.5 L/ha 0.6 L/ha 1.04 L/ha 2.5 L/ha	0.63 L/ac 0.2 L/ac 0.24 L/ac 0.42 L/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 8 leaf stage of corn.
foramsulfuron plus bromoxynil plus atrazine plus UAN	35 g/ha 0.14 kg/ha 0.5 kg/ha 2.5 L/ha		
OPTION 2.25 OD (22.5 g/L) plus PEAKPLUS ¹ (PEAK (75 WG) + BANVEL II (480 g/L)) plus liquid urea ammonium nitrate (UAN)	1.56 L/ha 13.3 g/ha + 0.3 L/ha 2.5 L/ha	0.63 L/ac 5.3 g/ac + 0.12 L/ac 1 L/ac	• Do NOT use on seed corn or sweet corn. • Apply up to the 7 leaf stage of corn.
foramsulfuron plus prosulfuron + dicamba plus urea ammonium nitrate	35 g/ha 10 g/ha + 0.14 kg/ha 2.5 L/ha		
PROWL 400 (400 g/L) plus ACCENT (75 DF) plus BANVEL II (480 g/L) or ORACLE (480 g/L) plus non-ionic surfactant	2.5 L/ha 16.7 g/ha 0.625 L/ha 2 L/1,000 L	1 L/ac 6.7 g/ac 0.25 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply early postemergence from the spike to 3 leaf stage of corn. • See precautions for PROWL, page 122, ACCENT, page 123 and BANVEL II or ORACLE, page 124.
pendimethalin plus nicosulfuron plus dicamba plus non-ionic surfactant	1 kg/ha 12.5 g/ha 300 g/ha 0.2% v/v		
PROWL 400 (400 g/L) plus SHOTGUN (390 g/L)	4.2 L/ha 2.4–3.59 L/ha	1.68 L/ac 0.96–1.44 L/ac	• Do NOT use on seed corn or sweet corn. • Apply at the spike to 3 leaf stage of corn. • Annual grasses should be no bigger than the 1–2 leaf stage. • Apply to medium and fine textured soils with more than 3% organic matter. • See precautions for PROWL alone POST, page 122 and SHOTGUN alone POST, page 127.
pendimethalin plus 2,4-D/atrazine	1.68 kg/ha 0.936–1.404 kg/ha		

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
ULTIM (75 DF) plus BANVEL II (480 g/L) or ORACLE (480 g/L) plus non-ionic surfactant	33 g/ha 0.6 L/ha 0.6 L/ha 2 L/1,000 L	13 g/ac 0.24 L/ac 0.24 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and BANVEL II or ORACLE is required. • See precautions for ULTIM alone, page 123 and BANVEL II alone, page 124.
nicosulfuron/rimsulfuron plus dicamba plus non-ionic surfactant	25 g/ha 0.288 kg/ha 0.2% v/v		
ULTIM (75 DF) plus CALLISTO (480 g/L) plus AATREX LIQUID (480 g/L) plus non-ionic surfactant	33 g/ha 0.21 L/ha 0.58 L/ha 2 L/1,000 L	13 g/ac 0.085 L/ha 0.235 L/ac 2 L/1,000 L	• Apply from the 3–6 leaf stage of corn. • Do NOT use on seed or sweet corn. • Apply in 100–200 L/ha of water. • See precautions for ULTIM alone, page 123 and CALLISTO plus AATREX LIQUID, page 125.
nicosulfuron/rimsulfuron plus mesotrione plus atrazine plus non-ionic surfactant	25 g/ha 0.1 kg/ha 0.28 kg/ha 0.2% v/v		
ULTIM TOTAL ¹ ULTIM (75 DF) + DISTINCT (70 WG) plus non-ionic surfactant plus liquid urea ammonium nitrate (UAN)	33 g/ha + 0.285 kg/ha 2.5 L/1,000 L 12.5 L/1,000 L	13 g/ac + 0.115 kg/ac 2.5 L/1,000 L 12.5 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply to active growth stage of seedling broadleaf weeds (less than 5 cm tall). • Apply to annual grasses in the 1–6 leaf stage and to quackgrass in the 3–6 leaf stage. • ULTIM TOTAL is AVAILABLE ONLY as a co-pack of ULTIM + DISTINCT. • 1 bag of ULTIM TOTAL treats 10 acres. • See precautions for ULTIM alone, page 123 and DISTINCT alone, page 125.
nicosulfuron/rimsulfuron + diflufenzopyr/dicamba plus non-ionic surfactant plus urea ammonium nitrate	25 g/ha + 0.2 kg/ha 0.25% v/v 12.5 L/1,000 L		
ULTIM (75 DF) plus MARKSMAN (393 g/L) plus non-ionic surfactant	33 g/ha 2.5 L/ha 2 L/1,000 L	13 g/ac 1 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply up to the 5 leaf stage of corn. • Apply one water soluble bag/ha of ULTIM. If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and MARKSMAN is required. • See precautions for ULTIM alone, page 123 and MARKSMAN alone, page 126.
nicosulfuron/rimsulfuron plus dicamba/atrazine plus non-ionic surfactant	25 g/ha 1.003 kg/ha 0.2% v/v		

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
ULTIM ((1:1) 75 DF) plus PARDNER (280 g/L) or KORIL, BROTEX (235 g/L) plus non-ionic surfactant	33 g/ha 1 L/ha 1.2 L/ha 2 L/1,000 L	13 g/ac 0.4 L/ac 0.5 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply from the 3–6 leaf stage of corn for optimum control. • One solupak of ULTIM treats 1 ha (2.5 ac). Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and PARDNER is required. • Do NOT apply ULTIM to corn treated with organophosphorous insecticides.
<i>nicosulfuron/rimsulfuron</i> <i>plus bromoxynil</i> <i>plus non-ionic surfactant</i>	25 g/ha 0.28 kg/ha 0.2% v/v		
ULTIM ((1:1) 75 DF) plus PARDNER (280 g/L) or KORIL, BROTEX (235 g/L) plus ATRAZINE 480 (480 g/L) plus non-ionic surfactant	33 g/ha 0.5 L/ha 0.6 L/ha 1.04 L/ha 2 L/1,000 L	13 g/ac 0.2 L/ac 0.24 L/ac 0.42 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply from the 3–6 leaf stage of field corn. • This treatment provides improved control of larger velvetleaf (up to 6 leaf stage) and common ragweed (up to 8 leaf stage) If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and PARDNER plus atrazine is required. • Note: some hybrids have shown sensitivity to ULTIM. • See precautions for ULTIM alone, page 123, PARDNER alone, page 126 and atrazine alone, page 124.
<i>nicosulfuron/rimsulfuron</i> <i>plus bromoxynil</i> <i>plus atrazine</i> <i>plus non-ionic surfactant</i>	25 g/ha 0.14 kg/ha 0.5 kg/ha 0.2% v/v		
ULTIM (75 DF) plus PEAKPLUS ¹ PEAK (75 WG) + BANVEL II (480 g/L) plus non-ionic surfactant	33 g/ha 13.3 g/ha + 0.3 L/ha 2 L/1,000 L	13 g/ac 5.3 g/ac + 0.12 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply to corn between the 2–6 leaf stage. • See precautions for ULTIM alone, page 123 and PEAKPLUS alone, page 127. • PEAKPLUS is a co-pack of PEAK and BANVEL II.
<i>nicosulfuron/rimsulfuron</i> <i>plus prosulfuron + dicamba</i> <i>plus non-ionic surfactant</i>	25 g/ha 10 g/ha + 0.14 kg/ha 0.2% v/v		
ULTIM (75 DF) SHOTGUN (390 g/L) plus non-ionic surfactant	33.7 g/ha 2.4–3.6 L/ha 2 L/1,000 L	13.4 g/ac 0.96–1.44 L/ac 2 L/1,000 L	• Do NOT use on seed corn or sweet corn. • Apply as an overall spray from 1–4 leaf stage of corn or 1–6 leaf stage of grasses. • See precautions for ULTIM alone, page 123 and SHOTGUN alone, page 127.
<i>nicosulfuron/rimsulfuron</i> <i>plus atrazine/2,4-D</i> <i>plus non-ionic surfactant</i>	25 g/ha 0.94–1.4 kg/ha 0.2% v/v		

¹ Indicates product sold as a co-pack.

GLYPHOSATE TOLERANT ("ROUNDUP READY") CORN

Weed Management Strategies for Glyphosate Tolerant Corn

There are four main strategies that one can use to manage weeds in glyphosate tolerant corn:

1. A single application of glyphosate
2. Glyphosate tank-mixed with a residual herbicide
3. Two in-crop applications of glyphosate
4. A preemergence application with a residual herbicide followed with an in crop application of glyphosate

Public research trials evaluated the performance of these four strategies at 11 locations over 2 growing seasons. Yield data from these trials are presented in Table 9-4 as a percentage of the top yielding treatment. In general, all four strategies can provide maximum yields in any given field provided it offers excellent weed control from the 3-8 leaf stage of corn.

TABLE 9-4. Corn Yield from Different Weed Management Strategies in Glyphosate Tolerant Corn

STRATEGY	PROS	CONS	YIELD(%)
"Two-Pass" Glyphosate <i>glyphosate applied at the 3-4 leaf stage of corn and again at the 7-8 leaf stage of corn</i>	- Typically provides the best weed control and corn yields. - Better perennial weed control.	- More expensive. - Increases selection pressure of glyphosate and chance of selecting herbicide resistant weed populations.	100
PRE/POST <i>residual herbicide applied PRE followed by glyphosate applied at the 7-8 leaf stage of corn</i>	- Typically provides the best weed control and corn yields. - Multiple herbicide modes of action to manage resistant weed populations. - Better perennial weed control.	More expensive.	99
"One-Pass" tank-mix with residual herbicide <i>glyphosate + residual herbicide applied at the 3-4 leaf stage of corn</i>	- Only one application. - Multiple herbicide modes of action to manage resistant weed populations.	- Timing too early to control many perennial weeds. - Reduced weed control when tank-mix partner does not provide residual control of weed spectrum in the field.	97
"One-Pass" Glyphosate (Early) <i>glyphosate applied at the 3-4 leaf stage of corn</i>	Only one application.	- Season long weed control not always possible. - Weeds emerging after application can significantly reduce yield.	96
"One-Pass" Glyphosate (Late) <i>glyphosate applied at the 7-8 leaf stage of corn</i>	Not recommended.	Not recommended.	90

Yield data collected from 11 replicated trials during the 2007 and 2008 growing seasons.

Source: Dr. P.H. Sikkema (Ridgetown Campus, University of Guelph) and Dr. R. Nurse (AAFC, Harrow).

TABLE 9-5. Glyphosate Tolerant "Roundup Ready" Corn Herbicide Weed Control Ratings

Trade Name	Annual Grasses									Annual Broadleaves											Perennials							Crop Tolerance	
	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	flabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
Preplant Burndown Herbicides – Refer to Tables 6-1. <i>Non-Selective Herbicides Available for Preplant Site Preparation</i> , page 77 and 6-2. <i>Preplant Herbicide Weed Control Ratings</i> , page 79 for a list of herbicides and weed control ratings.																													
"One-Pass" Treatments for Glyphosate Tolerant Hybrids Only																													
glyphosate ^a (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	7/8	9	7/8	-	8	7	9	8	9	E ^a
"One-Pass" Tank-Mixes with residual weed control for Glyphosate Tolerant Hybrids Only																													
GALAXY ^a (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	7/8	9	7/8	-	8	7	9	8	9	G ^a
Residual Weed Control	-	-	9	8	8	8	8	8	9	8	-	-	-	8	7	-	7	8	7	-	5	2	0	0	0	7	0	0	
GALAXY ^a + atrazine ^a (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	7/8	9	7/8	-	8	7	9	8	9	G ^a
Residual Weed Control	-	-	9	8	8	8	8	8	9	9	7	9	-	9	7	9	9	8	9	6	5	2	0	0	0	7	0	0	
glyphosate ^a + atrazine (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	7/8	9	7/8	-	8	7	9	8	9	E ^a
Residual Weed Control	2	2	2	2	2	2	2	2	2	9	7	9	-	9	9	9	9	9	9	6	5	2	0	0	0	0	0	0	
glyphosate ^a + CALLISTO + AATREX LIQUID 480 (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	9	8	9	7/8	-	8	7	9	8	9	E ^a
Residual Weed Control	2	0	2	0	2	2	2	2	2	9	6	9	-	9	9	9	9	9	9	6	9	2	0	0	0	0	0	0	
glyphosate ^a + IMPACT + atrazine (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	9	9	7/8	-	8	7	9	8	9	E ^a
Residual Weed Control	6	0	6	0	6	6	0	0	0	8	7	9	-	9	9	9	9	9	9	6	6	0	0	0	0	0	0	0	
glyphosate ^a + MARKSMAN or PROPERO (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	9	9	7/8	-	8	7	9	8	9	E ^a
Residual Weed Control	2	2	2	2	2	2	2	2	2	9	7	9	-	9	9	9	9	9	9	7	8	2	0	0	0	2	2	2	
glyphosate ^a + PRIMEXTRA II MAGNUM (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	7/8	9	7/8	-	8	7	9	8	9	E ^a
Residual Weed Control	9	9	9	8	8	9	9	9	2	9	7	9	-	9	9	9	9	9	9	-	5	0	0	0	3	0	0	0	
HALEX GT + AATREX (<i>Emerged Weeds</i>)	9	9	9	9	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	8	9	7/8	-	8	7	9	8	9	E ^a
Residual Weed Control	9	9	9	9	9	9	9	9	4	9	8	-	-	9	9	9	9	9	8	6	9	2	0	0	3	0	0	0	

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

¹ Indicates herbicides sold as a co-pack under this trade name.

- Insufficient information available to make a rating.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

² Use the high rate of herbicide for optimum control.

³ To achieve this level of control, volunteer cereals must be sprayed prior to flag leaf.

⁴ For use on "Roundup Ready" corn (glyphosate tolerant) only. See Table 9-7. *Glyphosate Product Rates and Tank Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn*, page 137 for a list of registered products and tank-mixes.

TABLE 9-6. Additional Weed Control Ratings for Glyphosate Tolerant "Roundup Ready" Corn

	Volunteer Crops		Grasses			Annual and Biennial Broadleaves											Perennials				
Trade Name	adzuki beans (volunteer)	wheat (volunteer)	sandbur	stink grass	tufted love grass	bur-cucumber	biennial wormwood	chickweed, common	flower of an hour	lettuce, prickly	nipplewort	spreading atriplex	swamp smartweed	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	horsenettle	red top	vetch, tufted	wirestem muhly
Postemergence Grass and Broadleaf Herbicides (Glyphosate Tolerant Hybrids Only)																					
glyphosate ⁴	9	9	9	-	-	8	8	9	9	9	-	7/8	5	8	9	-	-	8	-	5	9
glyphosate ⁴ + atrazine*	9	9	9	-	-	8	8	9	9	9	9	7/8	5	9	9	2	9	8	-	5	9
glyphosate ⁴ + CALLISTO + AATREX	9	9	9	-	-	8	8	9	9	9	6	5	5	8	9	8	-	8	0	6	9
glyphosate ⁴ + MARKSMAN, PROPERO	9	9	9	-	-	8	9	9	9	9	9	7/8	5	9	9	9	-	8	-	8	9

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

- Insufficient information available to make a rating.

^a Use the high rate of herbicide for optimum control.

^b To achieve this level of control, volunteer cereals must be sprayed prior to flag leaf.

^c Volunteer cereals are close to heading when these products are normally applied, earlier applications will improve control.

^d For use on "Roundup Ready" corn (glyphosate tolerant) only. See Table 9-7. *Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn*, page 137 for a list of registered products and tank-mixes.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 9-7. Glyphosate Product Rates and Tank-Mix Partners for Use on Glyphosate Tolerant "Roundup Ready" Corn

Glyphosate Products				TANK-MIX PARTNERS								
	ACTIVE INGREDIENT RATE:			atrazine*	CALLISTO + atrazine	DUAL II MAGNUM	DUAL II MAGNUM + CALLISTO	ELIM EP (GALAXY)	ELIM EP + atrazine	IMPACT + atrazine	MARKSMAN	PRIMEXTRA II MAGNUM
	0.9 kg/ha	1.35 kg/ha	1.8 kg/ha									
	EQUIVALENT PRODUCT RATE:											
CREDIT PLUS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓	✓			✓	✓	✓	✓	✓
CREDIT 45 (450 g/L)	0.8 L/ac	1.2 L/ac	1.6 L/ac	✓						✓	✓	
FACTOR 540 GLYPHOSATE (540 g/L)	0.67 L/ac	1 L/ac	1.34 L/ac					✓	✓	✓	✓	
GLYFOS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓	✓					✓	✓	
ROUNDUP ULTRA2 (540 g/L)	0.67 L/ac	1 L/ac	1.34 L/ac	✓				✓	✓	✓	✓	
ROUNDUP WEATHERMAX (540 g/L)	0.67 L/ac	1 L/ac	1.34 L/ac	✓				✓	✓	✓	✓	
SHARPSHOOTER PLUS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓						✓	✓	
TOUCHDOWN TOTAL (500 g/L)**	0.72 L/ac	1.1 L/ac	1.44 L/ac	✓	✓	✓	✓	✓	✓	✓	✓	✓
VANTAGE PLUS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓	✓				✓	✓	✓	✓
VANTAGE PLUS MAX (480 g/L)	0.75 L/ac	1.13 L/ac	1.5 L/ac	✓						✓	✓	

*Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23.

**TOUCHDOWN TOTAL can also be tank-mixed with PROPERO (dicamba/atrazine, 393 g/L).

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Preplant Burndown and Residual Control			
• Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one-pass" weed management program. • Refer to Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for preplant application rates for glyphosate and GRAMAXONE. • It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. atrazine, CONVERGE PRO, PRIMEXTRA II MAGNUM) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
"One-Pass" Postemergence Treatments in Glyphosate Tolerant Corn Only			
glyphosate*	See Table 9-7	See Table 9-7	• Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. See Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 137, for a list of registered glyphosate products. • Apply up to and including the 8 leaf stage of corn. • Applications should be timed to keep the corn crop weed-free from the 3–8 leaf stage of corn.
glyphosate	0.9–1.8 kg/ha		
* Numerous products exist. Refer to Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i> , page 137 for a complete list.			

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
"One-Pass" Postemergence Tank-mixes with Residual Control for use in Glyphosate Tolerant Corn Only			
GALAXY ¹ ELIM EP (25 DF) + ROUNDUP WEATHERMAX (540 g/L)	50 g/ha + 1.67 L/ha	20 g/ac + 0.67 L/ac	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - Apply spike to the 6 leaf stage corn. - Use on corn with corn heat units (CHU) greater than 2,500. - Water Volume: 140–190L/ha. - Provides residual control of fall panicum, green foxtail, lamb's-quarters and pigweed spp.
rimsulfuron + glyphosate	12.5 g/ha + 0.9 kg/ha		
glyphosate* plus ATRAZINE 480 (480 g/L)	See Table 9-7 1.56–2.1 L/ha	See Table 9-7 0.63–0.85 L/ac	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - Apply up to and including the 5 leaf stage of corn. - Atrazine will provide residual control of broadleaf weeds. - Refer to Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 137 for a list of glyphosate products that can be tank-mixed with atrazine.
glyphosate plus atrazine	0.9 kg/ha 0.75–1.0 kg/ha		
glyphosate* plus CALLISTO (480 g/L) plus AATREX LIQUID (480 g/L) plus non-ionic surfactant	See Table 9-7 0.21 L/ha 0.58 L/ha 2 L/1,000 L	See Table 9-7 0.085 L/ac 0.235 L/ac 2 L/1,000 L	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - Apply up to and including the 8 leaf stage of corn. - CALLISTO and Atrazine will provide residual broadleaf weed control. - Refer to Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 137 for a complete list of glyphosate products that can be tank-mixed with CALLISTO plus AATREX LIQUID.
glyphosate plus mesotrione plus atrazine plus non-ionic surfactant	0.9 kg/ha 0.1 kg/ha 0.28 kg/ha 0.2% v/v		
glyphosate* plus IMPACT (336 g/L) plus atrazine (480 g/L)*	See Table 9-7 37 mL/ha 1.04 L/ha	See Table 9-7 15 mL/ac 0.42 L/ac	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - Apply up to and including the 7 leaf stage of corn. - Refer to Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 137 for a complete list of glyphosate products that can be tank-mixed with IMPACT plus atrazine.
glyphosate* topramezone plus dimethenamid plus atrazine	0.9 kg/ha 0.0125 kg/ha 1.0 kg/ha 0.5 kg/ha		
glyphosate* plus MARKSMAN (393 g/L) or PROPERO (393 g/L)	See Table 9-7 2.5–3.7 L/ha	See Table 9-7 1–1.5 L/ac	- Use ONLY with pedigreed (certified) corn seed designated as "Roundup Ready" corn. - Apply up to and including the 5 leaf stage of corn. - Marksman will provide residual control of broadleaf weeds. - See precautions for BANVEL II or ORACLE applied POST, page 124. - Refer to Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 137 for a list of glyphosate products that can be tank-mixed with dicamba/atrazine.
glyphosate plus dicamba/atrazine	0.9 kg/ha 1–1.5 kg/ha		

* Numerous products exist. Refer to Table 9-7. *Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn*, page 137 for a complete list.

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
glyphosate* plus PRIMEXTRA II MAGNUM (1:0.8) 720 g/L)	See Table 9-7 2.5 L/ha	See Table 9-7 1.0 L/ac	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - Apply up to and including the 6 leaf stage of corn. - PRIMEXTRA II MAGNUM will provide residual grass and broadleaf weed control. - For tank-mixtures of PRIMEXTRA II MAGNUM plus any of the glyphosate products, to ensure optimum compatibility: Add PRIMEXTRA II MAGNUM to the tank first, then add AGRAL 90, AGSURF or COMPANION at 2.5 L/1,000 L. Continue agitation and then add glyphosate. - Refer to Table 9-7. <i>Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 137 for a complete list of glyphosate products that can be tank-mixed with PRIMEXTRA II MAGNUM.
glyphosate plus s-metolachlor/benoxacor/ atrazine	0.9 kg/ha 1.8 kg/ha		
HALEX GT (525 g/L) plus AATREX 480 (480 g/L) plus non-ionic surfactant	4.2 L/ha 0.58 L/ha 2 L/1,000 L	1.7 L/ac 0.235 L/ac 2 L/1,000 L	
glyphosate/s-metolachlor/ mesotrione plus atrazine plus non-ionic surfactant	2,205 g/ha 0.28 kg/ha 0.2% v/v		- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - Apply up to and including the 6 leaf stage of corn. - The addition of atrazine improves control of wild buckwheat, cocklebur, lady's-thumb, common and giant ragweed.
"Pre/Post" Strategies in Glyphosate Tolerant Corn Only			
PRE : PRIMEXTRA II MAGNUM (1:0.8) 720 g/L)	2.5 L/ha	1 L/ac	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. - The reduced rate of PRIMEXTRA II MAGNUM (1 L/ac) provides suppression of labeled weeds and is part of a planned weed management program that includes a follow-up postemergence treatment of glyphosate.
s-metolachlor/benoxacor/ atrazine	1.8 kg/ha		
POST : glyphosate*	See Table 9-7	See Table 9-7	
glyphosate	0.9 kg/ha		
"Two-Pass" Postemergence Treatments in Glyphosate Tolerant Corn Only			
glyphosate*	See Table 9-7	See Table 9-7	- Use ONLY with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. See Table 9-7. <i>Glyphosate Product Rates and Tank Mix Partners for Use on Glyphosate Tolerant "Roundup Ready" Corn</i>, page 105 for a list of registered glyphosate products. - The initial application is recommended between the 3–5 leaf to remove early competition. A second application may be applied up to the 8 leaf stage of corn. - Use 100–200 L/ha (40–80 L/ac) of water.
glyphosate	0.9–1.8 kg/ha		

* Numerous products exist. Refer to Table 9-7. *Glyphosate Product Rates and Tank-Mix Partners For Use on Glyphosate Tolerant "Roundup Ready" Corn*, page 137 for a complete list.

GLUFOSINATE TOLERANT ("LIBERTY LINK") CORN

Weed Management Strategies for Glufosinate Tolerant Corn

There are three main strategies that one can use to manage weeds in glufosinate tolerant ("Liberty Link") corn:

1. A single application of LIBERTY.
2. LIBERTY tank-mixed with a residual herbicide.
3. Two in-crop applications of LIBERTY.
4. A preemergence application with a residual herbicide followed with an in-crop application of LIBERTY.

Grain yield and weed control associated with any of the above four strategies is similar to what has been observed by the University of Guelph in glyphosate tolerant corn, refer to Table 9-8, page 140. In general, LIBERTY provides optimum weed control under hot humid conditions, when application are made during the day (versus the morning or evening) and when spray coverage is thorough. Cool conditions, weed size, and dew on weed leaves will reduce the level of control of LIBERTY even at labeled rates.

TABLE 9-8. Glufosinate "Liberty Link" Tolerant Corn Herbicide Weed Control Ratings

Trade Name	Annual Grasses									Annual Broadleaves											Perennials							Crop Tolerance	
	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
Preplant Burndown Herbicides – Refer to Tables 6-1. Non-Selective Herbicides Available for Preplant Site Preparation, page 77 and 6-2. Preplant Herbicide Weed Control Ratings, page 79 for a list of herbicides and weed control ratings.																													
“One-Pass” Treatments for “Liberty Link” Hybrids Only																													
LIBERTY 200 SN ³ (Emerged Weeds)	9	9	9	9	9	9	8/9	9	9	8	9	-	7	8/9	8	9	9	9	9	-	8	6	6	-	6	6/7	8	7	E ³
“One-Pass” Tank-mixes with Residual Weed Control for “Liberty Link” Hybrids Only																													
LIBERTY 200 SN ³ + atrazine (Emerged Weeds)	9	9	9	9	9	9	8/9	9	9	8	9	9	7	8/9	8	9	9	9	9	-	8/9	6	6	-	6	6/7	8	7	E ³
Residual Weed Control	2	2	2	2	2	2	2	2	2	9	7	9	-	9	9	9	9	9	9	6	5	2	0	0	0	0	0	0	
LIBERTY 200 SN ³ + BANVEL II (Emerged Weeds)	9	9	9	9	9	9	8/9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	6	-	6	6/7	9	8	E ³
Residual Weed Control	0	0	0	0	0	0	0	0	0	8	7	8	-	9	9	6	9	9	9	7	8	2	0	0	0	0	2	2	
LIBERTY 200 SN ³ + DISTINCT (Emerged Weeds)	9	9	9	9	9	9	8/9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	6	-	6	6/7	9	9	E ³

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

- Insufficient information available to make a rating.

³ For use on "Liberty Link" corn (glufosinate tolerant) only.

TABLE 9-8. Glufosinate "Liberty Link" Tolerant Corn Herbicide Weed Control Ratings (cont'd)

Trade Name	Annual Grasses									Annual Broadleaves											Perennials							Crop Tolerance		
	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada	
LIBERTY 200 SN ³ + MARKSMAN or PROPERO (Emerged Weeds)	9	9	9	9	9	9	8/9	9	9	9	9	-	9	9	9	9	9	9	9	9	9	8	6	-	6	6/7	8	8	E ³	
Residual Weed Control	2	2	2	2	2	2	2	2	2	9	7	9	-	9	9	9	9	9	9	9	7	8	2	0	0	0	2	2	2	
LIBERTY 200 SN ³ + PROWL (Emerged Weeds)	9	9	9	9	9	9	8/9	9	9	8	9	-	7	8/9	9	9	9	9	9	9	-	8	6	6	-	6	6/7	8	7	E ³
Residual Weed Control	9	9	9	9	8	8	8	-	5	-	-	-	-	6	9	0	8	8	2	-	6	-	-	-	-	-	-	-	-	

* Various formulations available, see Table 4-1, *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

- Insufficient information available to make a rating.

³ For use on "Liberty Link" corn (glufosinate tolerant) only.

TABLE 9-9. Additional Weed Control Ratings for Glufosinate "Liberty Link" Corn

	Volunteer Crops	Grasses			Annual and Biennial Broadleaves												Perennials			
Trade Name	adzuki beans (volunteer) wheat (volunteer)	sandbur	stink grass	tufted love grass	bur-cucumber	biennial wormwood	chickweed, common	flower of an hour	lettuce, prickly	nipplewort	spreading atriplex	swamp smartweed	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	horsenettle	red top	vetch, tufted	wirestem muhly
Postemergence Grass and Broadleaf Herbicides ("Liberty Link" Hybrids Only)																				
LIBERTY 200 SN ²	- -	7 - -			4 - -	- -	7 - -	- -	- -	1 6	- -	- -					7 - -			8
LIBERTY 200 SN ² + atrazine	- 2	7 - -			5 8 9	7 - -	9 2 0	9 0 2	9 6 9								7 - -			8
LIBERTY 200 SN ² + BANVEL II	- 0	7 - -			2 9 9	9 8 9	7 6 7	9 6 9									7 - -		8 8	
LIBERTY 200 SN ² + DISTINCT	- -	7 - -			4 9 9	9 8 9	7 5 9	9 8 -									7 - -		8 8	
LIBERTY 200 SN ² + MARKSMAN or PROPERO	- -	7 - -			6 9 9	9 9 9	7 3 9	9 9 -									7 - -		8 8	

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

¹ Indicates herbicides sold as a co-pack under this trade name.

² For use on "Liberty Link" (glufosinate tolerant) corn only.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

* Use the high rate of herbicide for optimum control.

¹ To achieve this level of control, volunteer cereals must be sprayed prior to flag leaf.

² Volunteer cereals are close to heading when these products are normally applied, earlier applications will improve control.

- Insufficient information available to make a rating.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Preplant Burndown and Residual Control

- Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one-pass" weed management program.
- Refer to Chapter 6. *Preplant & Postharvest Weed Control*, page 77 for preplant application rates for glyphosate and GRAMAXONE.
- It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. atrazine, Converge Pro, Primextra II Magnum) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.

"One-Pass" Postemergence Treatments for Glufosinate ("Liberty Link") Tolerant Corn Only

LIBERTY 200 SN (200 g/L)	2.5 L/ha	1 L/ac	- Use ONLY on field and seed corn specially developed to be tolerant to LIBERTY 200 SN. - LIBERTY 200 SN can be applied from the 1–8 leaf stage of corn. - LIBERTY 200 SN is a contact herbicide and has no residual activity. Consult the product label for rate recommendations for specific weeds and weed stages. Ammonium sulphate can be applied at 6 L/ha (2.4 L/ac) (liquid) or 3.3 kg/ha (1.3 kg/ac) (dry) for improved control of specific weeds. Do NOT add oil or any other surfactants.
glufosinate ammonium	0.5 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
"One-Pass" Tank-mixes with Residual Control for Glufosinate ("Liberty Link") Tolerant Corn Only			
LIBERTY 200 SN (200 g/L) plus ATRAZINE 480 (480 g/L)	2.5 L/ha 1.75–2.34 L/ha	1 L/ac 0.7–0.93 L/ac	• Use ONLY on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 8 leaf stage of corn.
<i>glufosinate ammonium</i> <i>plus atrazine</i>	0.5 kg/ha 0.84–1.12 kg/ha		
LIBERTY 200 SN (200 g/L) plus BANVEL II (480 g/L)	2.5 L/ha 0.625 L/ha	1 L/ac 0.25 L/ac	• Use ONLY on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 5 leaf stage of corn. • See precautions for BANVEL II alone POST, page 124.
<i>glufosinate ammonium</i> <i>plus dicamba</i>	0.5 kg/ha 0.3 kg/ha		
LIBERTY 200 SN (200 g/L) plus DISTINCT (70 WG)	2.5 L/ha 0.285 kg/ha	1 L/ac 0.114 kg/ha	• Use ONLY on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 5 leaf stage of corn. • See precautions for DISTINCT alone POST, page 125.
<i>diflufenzopyr/dicamba</i>	0.2 kg/ha		
LIBERTY 200 SN (200 g/L) plus MARKSMAN (393 g/L) or PROPERO (393 g/L)	2.5 L/ha 2.5–3.7 L/ha	1 L/ac 1–1.5 L/ac	• Use ONLY on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 5 leaf stage of corn. • See precautions for BANVEL II alone POST, page 124.
<i>glufosinate ammonium plus</i> <i>dicamba/atrazine</i>	0.5 kg/ha 1–1.5 kg/ha		
LIBERTY 200 SN (200 g/L) PROWL 400 (400 g/L)	2.5 L/ha 2.5 L/ha	1 L/ac 1 L/ac	• Use ONLY on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 4 leaf stage of corn.
<i>glufosinate ammonium</i> <i>plus pendimethalin</i>	0.5 kg/ha 1 kg/ha		
"Two-Pass" Postemergence Treatments for Glufosinate ("Liberty Link") Tolerant Corn Only			
LIBERTY 200 SN (200 g/L) followed by LIBERTY 200 SN (200 g/L)	2.5 L/ha 2 L/ha	1 L/ac 0.8 L/ac	• Use ONLY on glufosinate tolerant ("Liberty Link") corn hybrids. • The first application may be applied on 4–5 leaf corn at the proper growth stage of the weeds. The second application may be made up to the 8 leaf stage of corn to control subsequent flushes of weeds.
<i>glufosinate ammonium</i> <i>glufosinate ammonium</i>	0.5 kg/ha 0.4 kg/ha		

TABLE 9-10. Maximum Weed Leaf Stages (or Height) for Postemergence Herbicide Applications in Corn

Trade Name	Application Window (corn leaf-over stage)	Annual Grass Weeds: Maximum Leaf Stage						Annual Broadleaf Weeds: Maximum Leaf Stage										Perennials
		barnyard grass	crabgrass	fall panicum	green foxtail	witchgrass	proso millet	buckwheat, wild	cocklebur	johnsonweed	lady's-thumb	lamb's-quarters	wild mustard	nightshade	pigweed	ragweed	velvetleaf	quackgrass
Postemergence Grass Herbicides																		
ACCENT	1-8 leaf	6	-	6	6	6	6	-	-	-	-	-	-	-	-	-	-	3-6
DUAL II MAGNUM	PRE-3 leaf	1	1	1	1	1	1	-	-	-	-	-	-	PRE	PRE	-	-	-
FRONTIER MAX	PRE-3 leaf	1	1	1	1	1	1	-	-	-	-	-	-	PRE	PRE	-	-	-
ULTIM	1-6 leaf	6	-	6	6	6	6	-	-	-	-	-	-	6	-	-	-	3-6
Postemergence Broadleaf Herbicides																		
atrazine	tolerant at all stages	-	-	-	-	-	-	PRE	-	10 cm	10 cm	10 cm	10 cm	10 cm	10 cm	7-10 cm	5-10 cm	-
BANVEL II or ORACLE	up to 5 leaf	-	-	-	-	-	-	4	4	4	4	4	4	4	4	4	4	-
BUCTRIL M or BADGE or MEXTROL	4-6 leaf	-	-	-	-	-	-	8	4	-	4	8	8	-	4	8	4	-
CALLISTO + atrazine	3-8 leaf	-	-	-	-	-	-	8	4	4	8	8	-	8	8	6	8	-
DISTINCT	2-6 leaf	-	-	-	-	-	-	6	6	6	6-8	6	6	6	6	6	6	-
IMPACT + atrazine	1-7 leaf	4	-	-	4	-	-	-	-	5	-	8	8	8	8	8	8	-
MARKSMAN, PROPERO	up to 5 leaf	-	-	-	-	-	-	4	4	4	4	4	4	4	4	4	4	-
PARDNER or BROTOX or KORIL	4-8 leaf	-	-	-	-	-	-	8	4	-	4	8	4	-	4	4	4	-
PARDNER or KORIL + atrazine	4-8 leaf	-	-	-	-	-	-	8	4	-	4	8	4	-	6	8	6	-
PEAKPLUS ¹	up to 6 leaf	-	-	-	-	-	-	-	6	5	4	6	12	-	6	8	6	-
SHOTGUN	spike-4 leaf	-	-	-	-	-	-	6	-	-	6	6	6	-	6	6	6	-

¹ Indicates herbicide sold as a "co-pack" under this trade name.

² For use only on glyphosate tolerant ("Roundup Ready") corn hybrids.

- Indicates that either the weed is not controlled by the corresponding herbicide, or not enough data is available to specify a maximum leaf stage.

Expressed as leaf stages except as indicated.

TABLE 9-10. Maximum Weed Leaf Stages (or Height) for Postemergence Herbicide Applications in Corn (cont'd)

Trade Name	Application Window (corn leaf-over stage)	Annual Grass Weeds: Maximum Leaf Stage						Annual Broadleaf Weeds: Maximum Leaf Stage										Perennials
		barnyard grass	crabgrass	fall panicum	green foxtail	witchgrass	proso millet	buckwheat, wild	cocklebur	jimsonweed	lady's-thumb	lamb's-quarters	wild mustard	nightshade	pigweed	ragweed	velvetleaf	quackgrass
Postemergence Broadleaf and Grass Herbicides																		
ACCENT 1-PASS ¹	1-7 leaf	6	-	6	6	6	6	-	6	-	4	6	12	-	6	8	6	3-6
ACCENT TOTAL ¹	2-8 leaf	6	-	6	6	6	6	6	6	6	6-8	6	6	6	6	6	6	3-6
BATTALION ¹	PRE-3 leaf	3	PRE	3	3	3	3	4	4	4	4	4	4	4	4	4	4	3
GALAXY ^{1,2}	1-6 leaf	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
glyphosate ²	up to 8 leaf	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	-
HALEX ²	spike to 6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	-
IMPACT + FRONTIER + atrazine	1-7 leaf	4	-	-	4	-	-	-	-	5	-	8	8	8	8	8	8	-
LIBERTY	up to 8 leaf	5	5	4	5	4	5	-	4	-	6	6	4	-	6	7	4	1-4
OPTION 2.250D	up to 8 leaf	6	-	4	5	4	5	-	-	-	-	8	7	5	7	4	4	6
PRIMEXTRA	PRE-3 leaf	2	2	2	2	2	2	PRE	-	2	2	2	2	2	2	2	2	-
ULTIM TOTAL	2-6 leaf	6	-	6	6	6	6	6	6	6	6-8	6	6	6	6	6	6	3-6

¹ Indicates herbicide sold as a "co-pack" under this trade name.

² For use only on glyphosate tolerant ("Roundup Ready") corn hybrids.

- Indicates that either the weed is not controlled by the corresponding herbicide, or not enough data is available to specify a maximum leaf stage.

Expressed as leaf stages except as indicated.



10. FORAGE CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 10-1. Forages Herbicide Weed Control Ratings

Trade Name	Crop								Grasses								Annual Broadleaves										Perennials															
	seedling alfalfa	seedling birdsfoot trefoil	seedling clovers	seedling forage grasses	established alfalfa	established birdsfoot trefoil	established clovers	pasture (mostly grasses)	forage sorghum and pearl millet	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	wild oats	buckwheat, wild	chickweed, common	cleavers	corn spurry	fleabane, Canada	hemnettle	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	chickweed, mouseeared	curled dock	dandelion	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada		
Soil Applied Grass Herbicides																																										
EPTAM	✓	✓								9	9	9	9	9	9	9	-	6	7	-	-	0	-	7	9	6	9	2	0	-	-	-	0	0	0	0	0	8	2	0	0	
TREFLAN or RIVAL or BONANZA	✓									9	9	9	9	9	9	9	8	5	-	-	-	0	5	2	8	2	8	2	1	3	-	-	0	0	0	0	0	0	0	0	0	
Postemergence Grass Herbicides																																										
ACHIEVE LIQUID ¹			✓ ¹							8	-	-	-	9	9	-	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASSURE II ¹				✓						9	8	9	9	9	9	9	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
VENTURE L	✓	✓	✓				✓	✓		9	8	9	8	8	8	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
KERB					✓	✓				8	8	6	-	8	8	-	-	-	8	0	0	0	0	0	0	0	0	6	0	5	0	0	0	0	0	0	0	0	8	0	0	
POAST ULTRA		✓	✓	✓						9	8	9	9	9	9	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	
SELECT	✓									9	8	9	9	9	9	9	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	

✓ Indicates herbicide registered for use.

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

- Insufficient information available to make a rating.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

¹ For seed crops only.

² Do not use on sweet clover.

³ On established legumes, use fall spot treatment only.

⁴ CLOVITOX PLUS and TOPSIDE not for established clovers.

⁵ SIMADEX not for established alfalfa.

Trade Name	Crop									Grasses				Annual Broadleaves								Perennials																	
	seedling alfalfa	seedling birdsfoot trefoil	seedling clovers	seedling forage grasses	established alfalfa	established birdsfoot trefoil	established clovers	pasture (mostly grasses)	forage sorghum and pearl millet	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	wild oats	buckwheat, wild	chickweed, common	cleavers	corn spurry	fleabane, Canada	hempenettle	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	chickweed, mouseeared	curled dock	dandelion	horsetail	milkweed	nutsedge	quackgrass	sow-thistle

Postemergence Broadleaf Herbicides

2,4-D*	✓	✓	✓															4	7	2	-	-	-	4	9	9	9	8	-	8	-	-	7	8	-	0	0	0	8	8	
2,4-DB: CALIBER or COBUTOX or EMBUTOX ^{2,3}	✓	✓	✓	✓	✓	✓	✓	✓	✓									4	5	-	-	-	-	4	7	8	9	8	-	8	8	-	-	-	-	-	0	0	8	8	
BANVEL II or ORACLE								✓										8	-	-	9	8	-	9	9	7	7	9	8	9	8	-	9	8	-	0	0	0	9	8	
BASAGRAN	✓			✓				✓										7	-	-	-	5	-	9	7	9	7	8	6	9	6	-	-	-	-	2	8	0	6	7	
INFINITY				✓ ¹														9	9	9	-	-	9	-	9	9	9	-	-	-	-	-	-	-	-	-	-	0	9	7	
MCPA*								✓										4	-	-	-	-	8	-	9	9	8	8	-	8	7	-	-	-	8	-	0	0	6	5	
MILESTONE								✓										9	-	-	-	-	-	-	-	-	-	-	9	-	-	9	-	-	6	-	-	-	-	9	9
PARDNER or BROTOX or KORIL								✓										8	2	-	2	-	2	8	9	7	7	9	-	9	5	-	-	-	0	0	0	0	6	5	
PEAKPLUS								✓										-	-	-	-	-	-	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-	-	-	-
TOPSIDE ⁴ or TROPOTOX PLUS or CLOVITOX PLUS ⁴		✓	✓					✓										7	2	-	-	-	8	-	9	9	9	8	-	9	8	-	-	-	-	-	0	0	9	9	

Postemergence Grass and Broadleaf Herbicides

GRAMOXONE		✓	✓							8	7	9	-	9	9	-	-	9	9	-	-	-	-	9	8	9	9	9	9	-	-	-	0	0	-	0	0	5	0	0
PRINCEP NINE-T or SIMADEX ⁵ or SIMAZINE		✓	✓	✓						6	8	8	-	-	8	8	9	9	-	-	-	-	-	9	9	9	9	8	-	6	7	-	-	-	-	-	-	6	-	-
PURSUIT ¹	✓ ¹	✓ ¹								8	7	7	7	9	9	8	8	8	8	-	-	2	-	9	9	9	9	8	6	9	2	-	-	6	2	2	7	5	2	2

Postemergence Tank-Mixes

2,4-DB* + MCPA* ^{2,3}	✓	0	0	0	0	0	0	0	0	8	5	-	-	-	-	7	9	9	9	-	-	8	-	-	-	-	-	0	0	8	8
MILESTONE + 2,4-D*	✓	0	0	0	0	0	0	0	0	9	-	-	-	-	-	9	9	9	9	9	9	9	-	8	8	8	-	-	-	9	9

✓ Indicates herbicide registered for use.

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

- Insufficient information available to make a rating.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

¹ For seed crops only.

² Do not use on sweet clover.

³ On established legumes, use fall spot treatment only.

⁴ CLOVITOX PLUS and TOPSIDE not for established clovers.

⁵ SIMADEX not for established alfalfa.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23
and Chapter 5. *Notes on Adjuvants*, page 69).

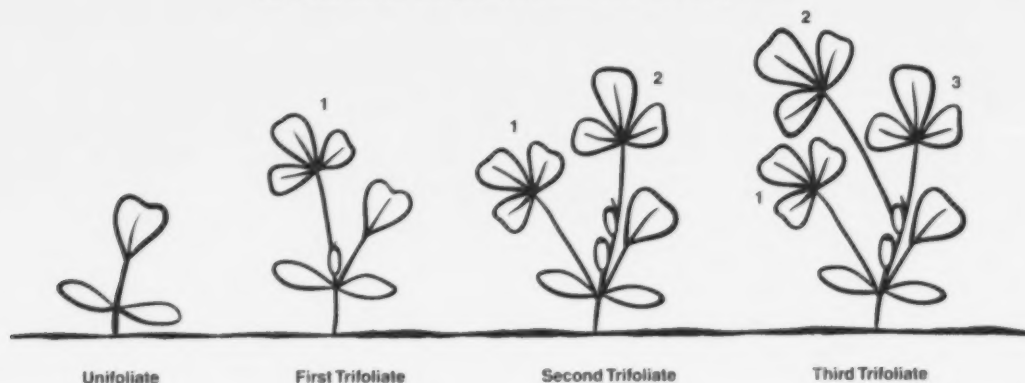
FORAGE GRASSES (SEED PRODUCTION ONLY)

Herbicide Treatments include:

- **Preplant (PP)** – Also see *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, on page 81 for details of products, rates and remarks.
- **Preplant Incorporated (PPI)** – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.
- **Preemergence (PRE)**
- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Apply all treatments in 100–200 L/ha (40–80 L/ac) water except where otherwise noted.

FIGURE 10-1. Stages of Alfalfa Leaf Development



Postemergence Grass Herbicides

ACHIEVE LIQUID (400 g/L) plus TURBOCHARGE	0.5 L/ha 0.5 L/100 L	0.2 L/ac 0.5 L/100 L	• Apply to wild oats, volunteer oats, green foxtail and yellow foxtail prior to tillering. Applications made to weeds that have tillered may result in unacceptable control.
tralkoxydim plus adjuvant	0.2 kg/ha 0.5% v/v		• For the following forage grasses grown for seed only: – Seedling and established intermediate and crested wheatgrass, creeping red fescue, meadow and smooth brome grass either underseeded to cereals or grown alone. – For establishment of northern wheatgrass, western wheatgrass and slender wheatgrass. • Do NOT tank mix ACHIEVE liquid with any other herbicides, insecticides, fungicides, fertilizers, micronutrients or adjuvants other than those listed on the label.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Postemergence Broadleaf Herbicides

INFINITY	0.83 L/ha	0.33 L/ac	• For use ONLY on Timothy grown for seed production. • Apply postemergence and prior to flag leaf emergence. • The addition of ammonium sulphate at 1 L/ha (0.4 L/ac) is required for the control of cleavers at the 4–6 whorl growth stage.
pyrasulfotole/bromoxynil	213 kg/ha		

FORAGE LEGUMES (DIRECT SEEDED)

Soil Applied Grass Herbicides

EPTAM (800 g/L)	4.25 L/ha	1.7 L/ac	• Apply PPI. • For pure stands of alfalfa or bird's-foot trefoil only. • Apply to a dry soil surface and incorporate into the soil immediately. • Some broadleaf weeds such as ragweed, mustards, and pigweeds frequently escape.
EPTC	3.4 kg/ha		
TREFLAN (480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac	• Apply PPI. • For pure stands of alfalfa only. • Use lower rate on sandy soils, higher rate for loam to clay soils.
or RIVAL (500 g/L)	1.2–2.3 L/ha	0.48–0.92 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
trifluralin	0.6–1.148 kg/ha		

Postemergence Grass Herbicides

POAST ULTRA (450 g/L) plus ASSIST or MERGE	0.32–0.47 L/ha 2 L/ha 1 L/ha	0.13–0.19 L/ac 0.8 L/ac 0.4 L/ac	• Apply POAST ULTRA to emerged annual grasses in the 1–6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. • Alfalfa is tolerant to POAST ULTRA at any stage of growth. • Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. • Complete control is normally obtained 7–21 days after application. • Allow 70 days between spraying and harvest.
sethoxydim plus oil concentrate or surfactant/solvent	0.15–0.2 kg/ha 2 L/ha 1 L/ha		
POAST ULTRA (450 g/L) plus MERGE	1.1 L/ha 1–2 L/ha	0.45 L/ac 0.4–0.8 L/ac	• Apply at the 1–3 leaf stage of actively growing quackgrass. • Thorough preplant tillage will give more uniform quackgrass emergence. • Gives 6–8 weeks control of quackgrass. • Allow 70 days between spraying and harvest.
sethoxydim plus surfactant/solvent	0.5 kg/ha 1–2 L/ha		
SELECT (240 g/L) plus AMIGO	0.13–0.38 L/ha 5–10 L/1,000 L	0.05–0.15 L/ac 5–10 L/1,000 L	• Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stage. • For pure stands of alfalfa only. • Alfalfa is tolerant at any growth stage. • Use the higher rate for control of quackgrass. • Allow 30 days between application and harvest.
clethodim plus surfactant	0.03–0.09 kg/ha 0.5% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
VENTURE L (125 g/L)	0.8–2 L/ha	0.32–0.8 L/ac	• Use the higher rate (2 L/ha (0.8 L/ac)) when quackgrass is present. • Apply at 2–4 leaf stage of annual grasses and at 3–5 leaf stage quackgrass. • VENTURE L may be tank-mixed with 2,4-DB at label rates for control of a broad range of weeds. (Consult 2,4-DB label). • Do NOT feed alfalfa to livestock within 41 days of treatment. • Do NOT feed or graze red clover or bird's-foot trefoil in the year of treatment.
fluzifop-p-butyl	0.1–0.25 kg/ha		
Postemergence Broadleaf Herbicides			
BASAGRAN (480 g/L) plus ASSIST	1.75–2.25 L/ha 1–2 L/ha	0.7–0.9 L/ac 0.4–0.8 L/ac	• For alfalfa seed production only. • Apply after third trifoliate stage of alfalfa. • Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/ac), 10 days apart. • Cool weather or drought may reduce control. • Reduce rate of oil concentrate to 1 L/ha (0.4 L/ac) under abnormally hot and humid weather conditions or temporary crop injury may occur.
bentazon plus oil concentrate	0.84–1.08 kg/ha 1–2 L/ha		
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L)	1.75–2.25 L/ha	0.7–0.9 L/ac	• Apply in at least 150 L/ha (60 L/ac) water, when alfalfa, bird's-foot trefoil or clovers are in the 1–4 leaf stage and seedling forage grasses are at the 2–4 leaf stage. • Do NOT graze or cut legumes for hay within 30 days of treatment. • NOT intended for grass forage crops grown for hay or grazing in the year of application. • Do NOT apply to crops grown for seed. • Do NOT apply under drought conditions. • 2,4-DB usually suppresses legume growth for a period of 2–3 weeks. • Severe injury to legumes may occur under drought, high temperature or other stress conditions.
2,4-DB	1.1–1.4 kg/ha		
CLOVITOX PLUS (400 g/L) or TROPOTOX PLUS (400 g/L) or TOPSIDE (400 g/L)	2.75–4.25 L/ha	1.1–1.7 L/ac	• Apply when clovers are at the unifoliate to the 4th trifoliate leaf stage and seedling forage grasses are at the 2–4 leaf stage. • Clovers may be suppressed for 2–3 weeks. • Do NOT exceed 3.5 L/ha of TOPSIDE for seedling forage grasses. • Do NOT apply TOPSIDE and TROPOTOX PLUS in less than 150 L/ha (60 L/ac) of water. • Do NOT apply CLOVITOX PLUS in less than 175 L/ha (70 L/ha) of water. • Do NOT apply CLOVITOX PLUS when temperatures exceed 27°C. • Do NOT apply under drought conditions. • Do NOT graze or cut for forage in the year of application.
MCPB/MCPA (15:1)	1.1–1.7 kg/ha		
Postemergence Tank-Mixes			
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L) plus MCPA Amine (500 g/L)	1.25 L/ha 70 mL/ha	0.5 L/ac 28 mL/ac	• Apply when the legumes are in the 1–4 leaf stage. • Do NOT graze or cut for hay within 30 days of treatment. • Do NOT apply to crops grown for seed. • The addition of MCPA gives better control of common mustard than 2,4-DB alone. • Apply in at least 150 L/ha (60 L/ac) water.
2,4-DB plus MCPA	0.8 kg/ha 35 g/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Postemergence Grass and Broadleaf Herbicides

PURSUIT (240 g/L) plus non-ionic surfactant plus liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)	0.312–0.42 L/ha 2.5 L/1,000 L 2 L/ha	0.125–0.168 L/ac 2.5 L/1,000 L 0.8 L/ac	• Apply only after the crop has one fully developed trifoliate leaf. • For seed alfalfa only. • One application per year. Apply when weeds are less than 7.5 cm tall. • Apply in 200 L/ha (80 L/ac) water.
imazethapyr plus non ionic surfactant plus liquid fertilizer	0.075–0.1 kg/ha 0.25% v/v 2 L/ha		

FORAGE LEGUMES (ESTABLISHED)

Postemergence Grass Herbicides

ASSURE II (96 g/L) plus SURE-MIX	0.375–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac	• Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2–6 leaf stage of growth. • For seed alfalfa only. • Do NOT graze or cut for hay in the year of treatment. • Use the 0.375 L/ha rate (0.15 L/ac) for control of volunteer corn, volunteer cereals and green foxtail. • The 0.5 L/ha (0.2 L/ac) rate provides suppression of quackgrass and will also control barnyard grass. • Use the 0.75 L/ha (0.3 L/ac) rate for control of quackgrass.
quizalofop-p-ethyl plus oil concentrate	0.036–0.072 kg/ha 0.5% v/v		
KERB (50 WP) propyzamide	2.25–3.25 kg/ha 1.125–1.625 kg/ha	0.9–1.3 kg/ac	• For grass control only in alfalfa and bird's-foot trefoil. • Apply in late September to early November before the soil freezes. • Do NOT graze or harvest treated forage within 90 days for the high rate and 60 days for lower rates.
POAST ULTRA (450 g/L) plus MERGE	1.1 L/ha 1–2 L/ha	0.45 L/ac 0.4–0.8 L/ac	• Apply at the 1–3 leaf stage of actively growing quackgrass. • Apply in 110–200 L/ha (44–80 L/ac) water. • Quackgrass control will be provided for 6–8 weeks. • Allow 70 days between spraying and harvest.
sethoxydim plus surfactant/solvent	0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L) fluzafop-p-butyl	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• Use the higher rate (2 L/ha (0.8 L/ac)) when quackgrass is present. • Apply at 2–4 leaf stage of annual grasses and at 3–5 leaf stage quackgrass. • VENTURE L may be tank-mixed with 2,4-DB at label rates for control of a broad range of weeds. (Consult 2,4-DB label). • Alfalfa may be fed to livestock 41 days after treatment. • Do NOT feed red clover or bird's-foot trefoil to livestock in the year of treatment.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicides			
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L)	2.25–2.75 L/ha	0.9–1.1 L/ac	• For pure stands or mixtures containing alfalfa or bird's-foot trefoil apply as spot treatment or when regrowth after cutting or grazing is not more than 7 cm high. • Do NOT graze or cut for hay within 30 days of treatment. • Do NOT apply to crops grown for seed. • Apply in at least 150 L/ha (60 L/ac) water.
2,4-DB	1.4–1.7 kg/ha		
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L)	2.25 L/ha	0.9 L/ac	• Apply to actively growing weeds in September or October when regrowth after cutting or grazing is not more than 7 cm high. • Apply in at least 150 L/ha (60 L/ac) water.
2,4-DB	1.4 kg/ha		
CLOVITOX PLUS (400 g/L) or TROPOTOX PLUS (400 g/L) or TOPSIDE (400g/L)	4.25 L/ha	1.7 L/ac	• For pure stands or mixtures containing red and alsike clovers. • Apply as spot treatment, or when regrowth after cutting or grazing is not more than 7 cm high.
MCPB/MCPA (15:1)	1.7 kg/ha		
Postemergence Grass and Broadleaf Herbicides			
glyphosate (360 g/L) or glyphosate (450 g/L) or glyphosate (480 g/L) or glyphosate (500 g/L) or glyphosate (540 g/L)	4.75–12 L/ha 3.8–9.6 L/ha 3.56–9 L/ha 3.42–8.64 L/ha 3.17–8 L/ha	1.7–4.8 L/ac 1.52–3.84 L/ac 1.42–3.6 L/ac 1.38–3.5 L/ac 1.27–3.2 L/ac	• SPOT TREATMENT ONLY: Apply when field bindweed has reached full bloom and other weeds are in the bud to full bloom stage. • Do NOT graze or harvest forage from treated spots until the treated plants turn brown.
glyphosate*	1.71–4.32 kg/ha		
GRAMOXONE (200 g/L)	2.8–5.5 L/ha	1.12–2.2 L/ac	• Apply to trefoil seed fields when the crop is about 15 cm high in the spring. • Apply to alfalfa or trefoil forage fields within 5 days after cutting. • Slow recovery and stand reduction has been observed under conditions of drought or high temperatures. • Do NOT use in the spring after treatment with simazine.
paraquat	0.56–1.1 kg/ha		
PURSUIT (240 g/L) plus non-ionic surfactant plus liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)	0.312–0.42 L/ha 2.5 L/1,000 L 2 L/ha	0.125–0.168 L/ac 2.5 L/1,000 L 0.8 L/ac	• Apply only after the crop has one fully developed trifoliate leaf. • For seed alfalfa only. • One application per year. Apply when weeds are less than 7.5 cm tall. • Apply in 200 L/ha (80 L/ac) water.
imazethapyr plus N.I.S. plus liquid fertilizer	0.075–0.1 kg/ha 0.25% v/v, 2 L/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
SIMADEx (500 g/L)	2.2 L/ha	0.88 L/ac	• Apply in September to November before freeze up.
or PRINCEP NINE-T (90 WG)	1.22 kg/ha	0.49 kg/ac	• This treatment prevents legume seedlings from establishing for approximately 8 months.
or SIMAZINE 80W (80 WP)	1.38 kg/ha	0.55 kg/ac	• Do NOT use SIMADEx on alfalfa.
			• Do NOT use in the fall before seeding another crop.
simazine	1.1 kg/ha		• Do NOT apply GRAMOXONE within 1 year after simazine application.
			• Do NOT apply to the same field for more than 3 consecutive years.
			• Allow 30 days between applications and grazing of cattle or sheep.

Preharvest

glyphosate (360 g/L)	2.5–5 L/ha	1–2 L/ac	• Apply 3–7 days prior to last cut in the final year of the forage. Forage can be harvested as hay, haylage or grazed.
or glyphosate (450 g/L)	2–4 L/ha	0.8–1.6 L/ac	
or glyphosate (480 g/L)	1.875–3.75 L/ha	0.75–1.5 L/ac	
or glyphosate (500 g/L)	1.8–3.6 L/ha	0.73–1.46 L/ac	
or glyphosate (540 g/L)	1.67–3.34 L/ha	0.67–1.34 L/ac	

glyphosate* 0.9–1.8 kg/ha

FORAGE SORGHUM AND FORAGE MILLET

Postemergence Broadleaf Herbicides

2,4-D Amine (470 g/L)*	0.6–1.2 L/ha	0.24–0.48 L/ac	• Apply when crop is at 4–6 leaf stage before closure of canopy.
			• Do NOT apply within 30 days of harvest.
2,4-D	0.28–0.56 kg/ha		• Do NOT spray in hot (over 27°C), humid weather.
BASAGRAN FORTÉ (480 g/L)	1.75–2.25 L/ha	0.7–0.9 L/ac	• Apply when crop is at 3–6 leaf stage before closure of canopy.
			• Do NOT apply within 30 days of harvest.
bentazon	0.84–1.08 kg/ha		• Hot, humid weather may result in temporary leaf yellowing.
PARDNER (280 g/L)	1 L/ha	0.4 L/ac	• Apply post in 200–300 L/ha of water.
or KORIL, BROTEX (235 g/L)	1.2 L/ha	0.48 L/ac	• Apply when the crop has more than 4 leaves, but before it is 20 cm tall.
			• Apply ONLY 1 application per year.
bromoxynil	0.28 kg/ha		• Do NOT harvest within 30 days of application.
PEAKPLUS ¹			• Apply when the crop is between 3–5 leaf stage.
(PEAK (75 WG)	13.3 g/ha	5.3 g/ac	• Best results when applied to actively growing weeds in the 1–6 leaf stage.
+ BANVEL (480 g/L)	+ 0.3 L/ha	+ 0.12 L/ac	• Do NOT apply by air.
plus AGRAL 90	2 L/1,000 L	2 L/1,000 L	• Make ONLY one application per year.
or ASSIST	10 L/1,000 L	10 L/1,000 L	
prosulfuron + dicamba	10 g/ha + 0.14 kg/ha		
plus non-ionic surfactant	0.2% v/v		
or crop oil concentrate	1% v/v		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

¹ Indicates herbicide is sold as a co-pack under this trade name.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

PASTURE RENOVATION WITH BIRD'S-FOOT TREFOIL

The introduction of this legume into a pasture requires control of competition from weeds and forage grasses for the first 2–4 months after the legume seed begins to germinate. Control of established perennial weeds should start at least one year before the legume seeding operation. Treatments recommended in Chapter 6. *Preplant & Postharvest Weed Control*, page 77, of this publication could be used. If the field cannot be plowed and worked to prepare a seedbed, one of the following chemical treatments can be used to suppress the sod.

The success of these programs depends on many management factors such as inoculation of the trefoil seed as well as control of fertility and grazing.

Postemergence Grass and Broadleaf Herbicides

glyphosate (360 g/L)	4.75–12 L/ha	1.9–4.8 L/ac	• Apply when the forage grasses have at least 2 leaves.
or glyphosate (450 g/L)	3.8–9.6 L/ha	1.52–3.84 L/ac	
or glyphosate (480 g/L)	3.56–9 L/ha	1.42–3.6 L/ac	
or glyphosate (500 g/L)	3.42–8.64 L/ha	1.37–3.46 L/ac	
or glyphosate (540 g/L)	3.17–8 L/ha	1.27–3.2 L/ac	
glyphosate*	1.71–4.32 kg/ha		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Broadcast seed and fertilizer in mid-April. • Apply GRAMOXONE in early May when the grass is 5–10 cm high before the legume seed germinates.
paraquat	1.1 kg/ha		

PASTURES (MOSTLY GRASSES)

Biennials: Unless otherwise noted, most chemicals are best applied in early fall to first year growth or in late spring to second year growth.

Perennials: Unless otherwise noted, apply in late spring (end of May to mid-June) when weeds are actively growing. Overgrazing tends to thin the grass stand and allows the establishment of weeds. Undergrazing allows weeds like wild carrot to form and spread seed. Timely mowing can prevent the ripening of weed seeds and reduce the distance these seeds spread with the wind.

- Chemicals are available to control most of the troublesome weeds in grass pastures and these can give faster kill of established weeds than any other management practice. A chemical may have to be applied more than once to kill established perennial weeds and the new crop of weeds that emerges through a thin grass stand. A poor grass stand can be improved by using a combination of chemicals, fertility and grazing management.
- Extend chemical weed control into fencerows and other areas around the pasture to keep these areas from becoming sources of weed seeds.
- Generally, clovers are severely damaged by chemical treatments. However, white clover and black medic show some resistance and re-establish quickly.
- Consult the label to determine the period of time to keep livestock out of the treated area.
- Prevent grazing where poisonous plants (water hemlock, buttercup, chokecherry, etc.) may be made more attractive to livestock after the chemical treatment. It is a good practice to prevent grazing on the field for at least a week after spraying to reduce the chances of the livestock consuming harmful plants.
- Apply chemical treatments in at least 200 L/ha (80 L/ac) water and increase this rate if it is necessary to contact weeds through dense vegetation.
- Avoid drift or vapour drift from 2,4-D or dicamba onto susceptible crops by using drift reducing techniques such as high spray volume, coarse droplets or anti-drift nozzles.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
2,4-D (470 g/L) or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	1.8–2.34 L/ha 1.5–1.95 L/ha 1.29–1.67 L/ha	0.72–0.94 L/ac 0.6–0.78 L/ac 0.52–0.67 L/ac	• Use the low rate for chicory. • Use the high rate for: – Goldenrod. – Yellow rocket: Mow before spraying if plants are in flowering stage. – Blueweed and burdock: Apply as low volatile ester. – Wild carrot: Early spring or early fall. If 2,4-D resistant strains are present, mow to reduce seed spread. – Goat's-beard: Early spring or early fall. – Milkweed: Spray undersides of leaves. Only top growth is killed. – Water hemlock: Apply in May or June. – Dandelion: Can also apply in September.
2,4-D*	0.85–1.1 kg/ha		
2,4-D (470 g/L) or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2.34–3.72 L/ha 1.95–3.1 L/ha 1.29–2.65 L/ha	0.94–1.49 L/ac 0.6–1.24 L/ac 0.52–1.06 L/ac	• For ox-eye daisy and hawk's-beard: Use 2 treatments, one in late spring and the second in early September if there is sufficient growth.
2,4-D*	1.1–1.75 kg/ha		
2,4-D (470 g/L) or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	4.5 L/ha 3.99 L/ha 3.40 L/ha	1.8 L/ac 1.6 L/ac 1.36 L/ac	• For tansy ragwort. • Apply to rosettes in spring or fall. • Retreat as necessary to control new seedlings and regrowth.
2,4-D*	2.25 kg/ha		
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)* plus BANVEL II (480 g/L) or ORACLE (480 g/L)	2.34 L/ha 1.95 L/ha 1.29 L/ha 2.1 L/ha	0.94 L/ac 0.6 L/ac 0.52 L/ac 0.84 L/ac	• For wild carrot. Apply in early fall for control of first year plants. • Wait 14 days between treatment and harvest or grazing for dairy animals. • Meat animals may graze or feed in treated pastures 30 days after dicamba application without restrictions on slaughter. • If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
2,4-D* plus dicamba	1.1 kg/ha 1.01 kg/ha		
AMITROL 240 (231 g/L) amitrole	0.165–0.46 L/10 L 0.038–0.106 kg/10 L		• SPOT TREATMENT ONLY • Lower rate for dandelion, Canada thistle, perennial sow-thistle, hoary cress, milkweed, poison-ivy, and toadflax. • Higher rate for horsetail and leafy spurge. • Spray to wet before flowering. • Keep animals away from treated area for 6–8 months.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
BANVEL II (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	1.25 L/ha 0.6 kg/ha	0.5 L/ac	• For all rates of dicamba: Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter. • For leafy and cypress spurges: for control of top growth, apply when weed is actively growing. • No delay is required between treatment and harvest or grazing for dairy animals.
BANVEL II (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	2.1 L/ha 1.01 kg/ha	0.84 L/ac	• For tansy ragwort: Apply when weed is actively growing. • Wait 7 days between treatment and harvest or grazing for dairy animals. • Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
BANVEL II (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	2.29 L/ha 1.1 kg/ha	0.92 L/ac	• For goldenrod: Apply when weed is actively growing. • Wait 14 days between treatment and harvest or grazing for dairy animals. • Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
BANVEL II (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	2.5 L/ha 1.2 kg/ha	1 L/ac	• For Canada thistle and field bindweed: Apply at bud stage of thistle and at flowering of bindweed. • Wait 14 days between treatment and harvest or grazing for dairy animals. • Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
BANVEL II (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	4.6 L/ha 2.212 kg/ha	1.84 L/ac	• For goat's beard: Apply when actively growing. • Wait 14 days between treatment and harvest or grazing for dairy animals. • Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
EMBUTOX (625 g/L) or CALIBER 625 (625 g/L) or COBUTOX 625 (625 g/L) 2,4-DB	2.75 L/ha 1.72 kg/ha	1.1 L/ac	• Nodding, Scotch, or bull thistles, perennial sow thistle, and chicory: Apply to rosette stage. • Yellow rocket: Apply in fall. • Plantains: Apply before flowering. • Curled dock: Apply to early growth. • Top growth only controlled for: – Canada thistle: Apply when 15 cm high to early bud stage. – Field bindweed: Apply in late summer. – Dandelion: Apply before bud stage. – Horsetail: Apply at 10–12 cm tall. • Do NOT graze or cut for forage in the year of treatment.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
CLOVITOX PLUS (400 g/L) or TROPOTOX PLUS (400 g/L) or TOPSIDE (400 g/L)	4.25 L/ha	1.7 L/ac	- Controls top growth of weeds only. Canada thistle: Apply when 15 cm high to early bud stage. Curled dock, plantains and perennial sow thistle: Apply to rosette stage. Buttercup and field bindweed: Apply in spring. Horsetail: Apply when 15 cm high. - This treatment has some safety on legumes. - Apply TOPSIDE after grazing or cutting when weeds are at a susceptible stage. Do NOT apply TOPSIDE and TROPOTOX PLUS in less than 150 L/ha (60 L/ac) of water. Do NOT apply CLOVITOX PLUS in less than 175 L/ha (70 L/ha) of water. Do NOT apply CLOVITOX PLUS when temperatures exceed 27°C. - For CLOVITOX PLUS and TOPSIDE: Do NOT apply under drought conditions. Do NOT graze or harvest for forage in the year of application.
MCPB/MCPA	1.7 kg/ha		
glyphosate (360 g/L) or glyphosate (450 g/L) or glyphosate (480 g/L) or glyphosate (500 g/L) or glyphosate (540 g/L)	4.75–12 L/ha 3.8–8 L/ha 3.56–9 L/ha 3.42–8.64 L/ha 3.17–8 L/ha	1.9–4.8 L/ac 1.52–3.2 L/ac 1.42–3.6 L/ac 1.37–3.46 L/ac 1.27–3.2 L/ac	SPOT TREATMENT ONLY: - For Canada thistle, field bindweed and milkweed. - Always use high rate for milkweed. - Apply when thistle and milkweed are in the bud to full bloom stage and bindweed is flowering. - For colt's-foot: Apply when leaves are fully expanded. - For tansy: Apply when tansy is in bud to full bloom stage. - Wait until the treated areas have turned brown before grazing.
glyphosate*	1.71–4.32 kg/ha		
MCPA (500 g/L)	2.2 L/ha	0.88 L/ac	- For buttercup: Use 2 treatments, one in June and the second in early September. - Wait 7 days after treatment before grazing.
MCPA*	1.1 kg/ha		
MILESTONE (240 g/L)	0.25–0.5 L/ha	0.10–0.20 L/ac	- Apply Postemergence. - Will control: absinth (biennial) wormwood, goldenrod, knapweed, scentless chamomile, Canada thistle, yellow star thistle, musk (nodding) thistle, sulphur cinquefoil and tropical soda apple. - Will suppress: common tansy and dandelion.
aminopyralid	60–120 g/ha		
MILESTONE (240 g/L) + 2,4-D Amine (564 g/L)	0.25–0.5 L/ha 1.49–2.55 L/ha	0.10–0.20 L/ac 0.596–1.02 L/ac	- Apply Postemergence. - For wider spectrum of weed control, 2,4-D Amine may be added at a ratio of 1 part MILESTONE ai/ha to 12 parts 2,4-D Amine ai/ha.
aminopyralid plus 2,4-D Amine	60–120 g/ha 840–1,440 g/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.



11. SOYBEANS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor. Under unfavourable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 11-1. Conventional Soybean Herbicide Weed Control Ratings

Trade Name	Grasses								Annual Broadleaves										Perennials							Crop Tolerance	
	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
Preplant Burndown Herbicides – Refer to Table 11-3. Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans, page 180 for a list of herbicides and weed control ratings.																											
Soil Applied Grass Herbicides																											
DUAL II MAGNUM	9	9	8	8	9	9	9	4	2	2	0	2	7	2	8	8	4	3	2	0	0	0	8 ^c	0	0	0	G
FRONTIER, FRONTIER MAX	9	9	8	8	9	9	9	4	2	2	0	2	7	2	8	8	4	3	2	0	0	0	8 ^c	0	0	0	G
TREFLAN, BONANZA, RIVAL	9	9	8	9	9	9	9	6	5	2	0	2	8	2	2	8	2	1	2	2	2	2	2	2	2	2	G
Soil Applied Broadleaf Herbicides																											
FIRSTRATE	0	0	0	0	0	0	0	0	-	9 ^a	9	-	9 ^a	-	2	9 ^a	9	9 ^a	9 ^a	-	2	-	-	2	6	-	E
LOROX	5	5	5	5	5	5	5	5	8	5	5	9	9	9	9	9 ^a	8	6	6	2	2	2	2	2	2	2	G
SENCOR	7	6	7	5	5	5	8	3	7	7	5	9	9 ^a	9 ^a	3	9 ^a	8 ^a	7	7	2	2	2	2	2	2	2	G
VALTERA	3	3	3	5	5	5	3	-	-	4	8	7	9	-	9	9	7	3	7	-	-	-	-	-	-	-	G
Soil Applied Grass and Broadleaf Herbicides																											
BOUNDARY	9	9	8	8	9	9	9	5	7	7	5	9	9 ^a	9 ^a	8	9	7 ^a	7	7	2	2	2	7	2	2	2	G
BROADSTRIKE DUAL MAGNUM	9	9	8	8	9	9	9	6	7	7	9	9	9 ^a	9	9	9	8 ^a	7	9	2	8	-	8 ^c	0	3	4	E
COMMAND 360 ME	9	9	-	-	9	9	-	-	-	-	-	-	9	-	9	6	8/9	-	9	-	-	-	-	-	-	-	E

* The high rate or a sequential application will be needed to achieve this level of control.

^c PPI timing is required to achieve this level of control.

- Insufficient information available to make a rating.

^a Indicates herbicides sold as a co-pack under this trade name.

^a Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 11-1. Conventional Soybean Herbicide Weed Control Ratings (cont'd)

Trade Name	Grasses								Annual Broadleaves										Perennials							Crop Tolerance		
	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada	
CONQUEST ¹	8	7	7	9	9	9	8	7	8	8	2	9	9 ^R	9	9 ^R	9 ^R	9 ^R	6	9	2	2	2	7	6	2	2	G	
PURSUIT	8	7	7	9 ^R	9 ^R	9	8	7	8	7 ^R	2	9	9 ^R	9	9 ^R	9 ^R	8 ^R	6	9	2	2	2	7	6	2	2	E	
VALOR	9	9	9	9	9	9	9	8	8	7 ^R	2	9	9	9	9	9	8 ^R	6	9	2	2	2	7	6	2	2	E	
Soil Applied Tank Mixes																												
COMMAND 360 ME + SENCOR	9	9	-	-	9	9	-	-	-	-	-	-	9	-	9	9 ^R	9	-	9	-	-	-	-	-	-	-	-	G
COMMAND 360 ME + LOROX	9	9	-	-	9	9	-	-	-	-	-	-	9	-	9	9 ^R	9	-	9	-	-	-	-	-	-	-	-	G
COMMAND 360 ME + PURSUIT	9	9	7	9	9	9	8	7	8	7	-	9	9	9	9	9 ^R	8/9	6	9	-	-	-	7	-	-	-	-	E
COMMAND 360 ME + DUAL II MAGNUM	9	9	8	9	9	9	9	4	-	-	-	-	9	-	9	8/9	8/9	-	9	-	-	-	8	-	-	-	-	E
DUAL + LOROX + SENCOR	9	9	8	8	9	9	9	5	8	7	5	9	9	9	8	9	8	7	7	2	2	2	7	2	2	2	2	G
DUAL II MAGNUM + LOROX	9	9	8	8	9	9	9	5	8	5	5	9	9	9	8	9	8	6	6	2	2	2	7	2	2	2	2	G
DUAL II MAGNUM + SENCOR	9	9	8	8	9	9	9	5	7	7	5	9	9 ^R	9 ^R	8	9	8 ^R	7	7	2	2	2	7	2	2	2	2	G
DUAL II MAGNUM+ PURSUIT	9	9	8	8	9	9	9	7	8	7 ^R	-	9	9 ^R	9	9	9	8 ^R	6	9	2	2	2	7	6	2	2	2	G
FRONTIER + SENCOR	9	9	8	8	9	9	9	5	7	7	5	9	9 ^R	9 ^R	8	9	8 ^R	7	7	2	2	2	8 ^c	2	2	2	2	G
FRONTIER MAX + PURSUIT	9	9	8	9	9	9	9	7	8	7 ^R	-	9	9 ^R	9	9	9	8 ^R	6	9	2	2	2	7	6	2	2	2	G
PURSUIT + FIRSTRATE	8	7	7	9 ^R	9 ^R	9	8	7	8	9 ^R	9	9	9 ^R	9	9 ^R	9 ^R	9 ^R	9	9	2	2	2	7	6	2	2	2	E
PURSUIT + LOROX	8	7	7	9 ^R	9 ^R	9	8	7	8	7 ^R	5	9	9	9	9	9	8	6	9	2	2	2	7	6	2	2	2	G
PURSUIT + SENCOR	8	7	7	9 ^R	9 ^R	9	8	5	8	7	5	9	9 ^R	9	9 ^R	9 ^R	8	7	9	2	2	2	7	6	2	2	2	G
PURSUIT + TREFLAN, BONANZA, RIVAL	9	9	8	9	9	9	9	7	8	7 ^R	-	9	9 ^R	9	9	9 ^R	8 ^R	6	9	2	2	2	7	6	2	2	2	G
TREFLAN, BONANZA, RIVAL + SENCOR	9	9	8	9	9	9	9	6	7	7	5	9	9	9	3	9	8	7	8	2	2	2	2	2	2	2	2	G
Postemergence Grass Herbicides																												
ASSURE II	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	E
EXCEL SUPER	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	E

* The high rate or a sequential application will be needed to achieve this level of control.

° PPI timing is required to achieve this level of control.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.^R Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.**BOLD** numbers indicate the weed is listed on the product label for control or suppression.

TABLE 11-1. Conventional Soybean Herbicide Weed Control Ratings (cont'd)

Trade Name	Grasses								Annual Broadleaves										Perennials							Crop Tolerance	
	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
POAST ULTRA	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	E
SELECT	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	E
VENTURE L	9	8	9	8	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	E	
Postemergent Broadleaf Herbicides																											
BASAGRAN FORTÉ	0	0	0	0	0	0	0	0	7	9	5	9	7	9	7	7	8	6	9	5	2	2	8	0	5	7	G
BLAZER	0	0	0	0	0	0	0	0	7	6	2	8	7	9	8	9	9	7	7	7	6	5	2	2	6	6	F
CLASSIC	0	0	0	0	0	0	0	0	4	8 ^R	8	8	3	9	3	9	8 ^R	8	8	2	2	8	8	2	8	4	G
FIRSTRATE	0	0	0	0	0	0	0	0	7	9 ^R	9	-	2	9	2	2	9 ^R	9	9	-	2	-	-	2	7	7	E
PINNACLE	0	0	0	0	0	0	0	0	-	5	2	8	9 ^R	8	3	9 ^R	5	2	8	2	2	2	2	2	2	2	G
REFLEX	0	0	0	0	0	0	0	0	8	7	2	8	6	9	8	9	9	7	6	3	6	2	-	0	5	3	G
Postemergence Grass and Broadleaf Herbicides																											
CLEAN SWEEP ¹	9	8	6	9 ^R	9 ^R	9	9	7	8	9	5	9	8	9	9 ^R	9 ^R	8	6	9	5	2	2	8	2	5	7	G
PURSUIT	9	8	6	9 ^R	9 ^R	9	9	7	8	8 ^R	2	9	8 ^R	9	9 ^R	9 ^R	8 ^R	6	9	2	2	2	7	2	2	2	G
Postemergence Tank-Mixes																											
ASSURE II + BASAGRAN FORTÉ + PINNACLE	9	8	9	9	9	9	9	9	7	9	5	9	9	9	7	9 ^R	8	6	9	6	2	2	8	9	5	7	G
ASSURE II + PINNACLE	9	8	9	9	9	9	9	9	-	5	2	8	9 ^R	8	3	9 ^R	5	2	8	2	2	2	2	9	2	2	G
ASSURE II + CLASSIC	9	8	9	9	9	9	9	9	4	9 ^R	8	8	3	9	3	9 ^R	8 ^R	8	8	2	2	8	8	9	8	4	G
BLAZER + BASAGRAN FORTÉ	0	0	0	0	0	0	0	0	7	9	5	9	8	9	8	9	9	6	9	7	6	5	8	2	6	7	F
EXCEL SUPER + BASAGRAN FORTÉ	9	8	9	9	9	9	9	9	7	9	5	9	8	9	7	7	8	6	9	6	2	2	8	4	5	7	G
EXCEL SUPER + BASAGRAN FORTÉ + PINNACLE	9	8	9	9	9	9	9	9	7	9	5	9	9	9	7	9 ^R	8	6	9	6	2	2	8	4	5	7	G
EXCEL SUPER + PINNACLE	9	8	9	9	9	9	9	9	-	5	2	8	9 ^R	8	3	9 ^R	5	2	8	2	2	2	2	4	2	2	G

* The high rate or a sequential application will be needed to achieve this level of control.

° PPI timing is required to achieve this level of control.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^R Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 11-1. Conventional Soybean Herbicide Weed Control Ratings (cont'd)

Trade Name	Grasses								Annual Broadleaves										Perennials							Crop Tolerance	
	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	flabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
PINNACLE + BASAGRAN FORTÉ	0	0	0	0	0	0	0	0	7	9	5	9	9	9	7	9 ^a	8	6	9	6	2	2	8	1	5	7	G
PINNACLE + REFLEX	0	0	0	0	0	0	0	0	8	7	2	8	9 ^a	9	8	9	9	7	8	-	-	-	-	-	-	-	G
PURSUIT + FIRSTRATE	9	8	6	9 ^a	9 ^a	9	9	7	8	9 ^a	9	9	8 ^a	9	9 ^a	9 ^a	9 ^a	9	9	2	2	-	7	2	7	7	G
PURSUIT + REFLEX	9	8	6	9 ^a	9 ^a	9	9	7	8	8 ^a	2	9	8 ^a	9	9 ^a	9	8	7	9	2	2	2	7	2	2	2	G
REFLEX + VENTURE L	9	8	9	8	8	9	9	9	8	7	2	8	6	9	8	9	9	7	6	3	6	2	-	0	5	3	G
VENTURE L + BASAGRAN	9	8	9	8	8	8	9	8	7	9	5	9	7	9	7	7	8	6	9	6	2	2	8	9	5	7	G

* The high rate or a sequential application will be needed to achieve this level of control.

^a PPI timing is required to achieve this level of control.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^a Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 11-2. Additional Weed Control Ratings in Conventional Soybean

Trade Name	Grasses		Annual and Biennial Broadleaf Weeds											Perennials		
	sandbur	vol. corn ²	beggarsticks, nodding	biennial wormwood	bur-cucumber	flower of an hour	prickly lettuce	spreading atriplex	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	violet, field	dandelion	horsenettle	wirestem muhly
Burndown Plus Residual Control Tank-Mixes																
GUARDIAN ^{1,2} (glyphosate + CLASSIC)	9	3	8	8	8	9	8	7/8	8	9	8	-	-	8	8	8
glyphosate + BOUNDARY ¹	-	0	-	8	-	-	4	8	7	-	5	-	-	7/8*	7/8*	7/8
glyphosate + BROADSTRIKE DUAL II MAGNUM	-	0	-	6	-	-	7	8	8	-	8	-	-	8*	8*	8
glyphosate + CONQUEST ¹	-	3	-	7	-	-	8	8	7	-	7	-	-	7/8*	7/8*	7/8
glyphosate + FIRST RATE	-	3	-	7	-	-	9	7	9	-	6	-	-	8*	8*	8
glyphosate + LOROX	-	0	-	8	-	-	4	8	6	-	1	-	-	8*	8*	8
glyphosate + PURSUIT	-	3	-	5	-	-	8	7	5	-	7	-	-	8*	8*	8
glyphosate + SENCOR	-	0	-	8	-	-	4	8/9	8	-	5	-	-	7/8*	7/8*	7/8
Soil Applied Grass Herbicides																
AXIOM	2	0	-	5	-	-	-	-	3	6	3	-	-	-	-	-
DUAL II MAGNUM	1	0	3	-	-	-	-	-	1	6	-	-	-	-	-	-
FRONTIER	1	0	-	-	-	-	-	-	1	6	-	-	-	-	-	-
Soil Applied Broadleaf Herbicides																
FIRSTRATE	-	3	9	6	-	-	-	-	8	1	6	9	-	-	-	-
LOROX	-	0	9	7	-	-	-	-	5	8	3	8	-	-	-	-
SENCOR	-	0	7	7	4	-	-	-	7	4	5	6	-	-	-	-
VALTERA	-	0	-	-	-	-	-	-	-	9	-	-	-	-	-	-
Soil Applied Grass and Broadleaf Herbicides																
BOUNDARY ¹	-	0	-	7	-	-	-	-	-	6	4	6	-	-	-	-
BROADSTRIKE DUAL II MAGNUM	-	0	9	5	-	-	-	-	8	6	6	8	-	-	-	-
PURSUIT	7	3	8	2	-	-	-	-	-	0	5	6	-	-	-	-

* Higher rates of glyphosate (i.e. 1.35 to 1.8 kg/ha) are required to achieve control of these perennial weeds.

- Insufficient information available to make a rating.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

¹ Indicates herbicides sold as a co-pack under this trade name.

² Glyphosate tolerant ("Roundup Ready") volunteer corn will not be controlled.

³ Dandelion must be less than 15 cm in diameter to achieve this level of control.

TABLE 11-2. Additional Weed Control Ratings in Conventional Soybean (cont'd)

Trade Name	Grasses		Annual and Biennial Broadleaf Weeds											Perennials		
	sandbur	vol. corn ²	beggarsticks, nodding	biennial wormwood	bur-cucumber	flower of an hour	prickly lettuce	spreading atriplex	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	violet, field	dandelion	horsenettle	wirestem muhly
Postemergence Grass Herbicides																
ASSURE II	9	9	0	0	0	0	0	0	0	0	0	0	-	0	0	6
EXCEL SUPER	8	8	0	0	0	0	0	0	0	0	0	0	-	0	0	2
POAST ULTRA	7	7	0	0	0	0	0	0	0	0	0	0	-	0	0	3
SELECT	7	7	0	0	0	0	0	0	0	0	0	0	-	0	0	3
VENTURE L	8	9	0	0	0	0	0	0	0	0	0	0	-	0	0	7
Postemergence Broadleaf Herbicides																
BASAGRAN FORTÉ	0	0	9	6	-	8	2	4	5	2	4	3	5	-	-	-
BLAZER	0	5	4	-	-	6	4	-	6	9	2	0	6	-	-	-
CLASSIC	0	3	9	6	5	7	6	-	7	0	8	5	6	8 ³	-	-
FIRSTRATE	0	3	9	6	-	8	6	-	7	1	6	8	9	6	6	-
PINNACLE	0	0	8	-	3	8	3	6	5	2	2	3	6	-	-	-
REFLEX	0	5	4	-	-	7	6	-	7	9	2	-	7	-	-	-
Postemergence Grass and Broadleaf Herbicides																
CLEANSWEEP ¹	6	3	9	7	-	8	1	5	6	2	5	6	-	-	-	-
PURSUIT	7	3	9	-	-	7	1	-	5	0	5	6	-	-	-	-

* Higher rates of glyphosate (i.e. 1.35 to 1.8 kg/ha) are required to achieve control of these perennial weeds.

- Insufficient information available to make a rating.

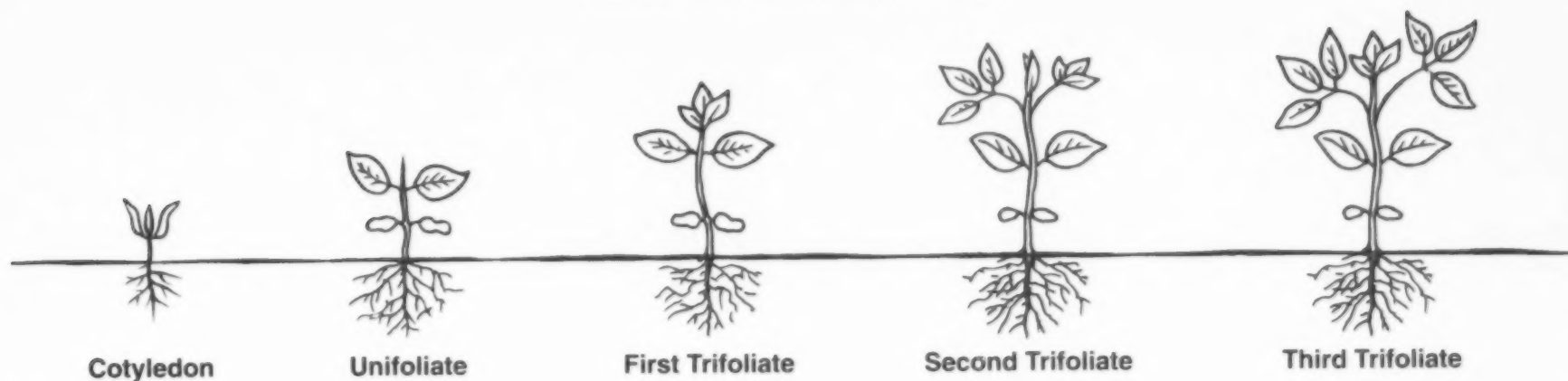
BOLD numbers indicate the weed is listed on the product label for control or suppression.

¹ Indicates herbicides sold as a co-pack under this trade name.

² Glyphosate tolerant ("Roundup Ready") volunteer corn will not be controlled.

³ Dandelion must be less than 15 cm in diameter to achieve this level of control.

FIGURE 11-1. Soybean Development Stages



Soybeans

Unless otherwise specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

Thoroughly clean all equipment used to apply ACCENT, ACCENT TOTAL, BANVEL II, BATTALION, DISTINCT, LONTREL, MARKSMAN, MCPA, ORACLE, PEAKPLUS, SHOTGUN, 2,4-D and other related herbicides immediately after use, as well as before spraying soybeans. See *Cleaning the Sprayer*, on page 12.

Total Weed Control System – Although herbicides themselves may be effective, there is a benefit to using all the weed control methods available to obtain the best control possible. Crop rotation, herbicide rotation, early weed control with a rotary hoe, harrowing, cultivating and preventing the spread of weeds as much as possible are all a part of weed management. See Chapter 9, *Corn (Field, Seed & Sweet)*, on page 105, for details of each of these methods.

Resistant Weeds – Biotypes of a number of weeds have been found resistant to Group 5 (triazine) and Group 2 herbicides. Refer to *Managing Weed Resistance to Herbicides*, on page 5, for management and control strategies.

Specific Weeds – For information on specific weeds see the Table 11-1, *Conventional Soybean Herbicide Weed Control Ratings*, on page 159. Then refer to the appropriate section for details about herbicide treatments.

Herbicide Treatments Include:

- **Preplant (PP)** – See *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, on page 81, for details of products, rates and remarks.
- **Preplant Incorporated (PPI)** – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread

perennial weeds to previously uninfested areas. Ensure machines are clean and/or treat fields with perennial weeds last.

- **Preemergence (PRE)** – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improves herbicide activity in the absence of rainfall.
- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Preplant Burndown Herbicides – Refer also to Chapter 6. *Preplant & Postharvest Weed Control*, page 77.

- Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one-pass" weed management program.
- Refer to Chapter 6. *Preplant & Postharvest Weed Control*, page 77 for preplant application rates for glyphosate and GRAMAXONE.
- It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. SENCOR, LOROX L) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.

CLEANSTART PLUS ¹			• Apply to actively growing weeds, up to 10 cm.
CREDIT PLUS (360 g/L) +	2.5 L/ha +	1.0 L/ac +	• Coverage of weed foliage is essential for control.
AIM EC (240 g/L)	73 mL/ha	30 mL/ac	• Only weeds emerged at application will be controlled.
glyphosate +	0.9 +		• CLEANSTART PLUS ¹ provides no residual weed control.
carfentrazone-ethyl	0.0175 kg/ha		• CLEANSTART PLUS ¹ is a co-pack of CREDIT PLUS and AIM EC.
GUARDIAN ¹			• Apply as a PP burndown.
TOUCHDOWN TOTAL (500 g/L)	1.8 L/ha +	0.72 L/ac +	• Some rotational restrictions apply (see CLASSIC label and Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i> , page 61).
+ CLASSIC (25 DF)	36 g/ha	14 g/ac	• GUARDIAN is a co-pack of TOUCHDOWN TOTAL + CLASSIC.
glyphosate +	0.9 kg/ha +		
chlorimuron-ethyl	9 g/ha		
glyphosate	See Table 11-5	See Table 11-5	• Apply to coarse and medium textured soils.
plus VALTERA (51.1%)	114 g/hc	56 g/ac	• Apply to soybeans prior to planting or within 3 days after planting but prior to soybean emergence.
glyphosate +	0.9 kg/ha +		• Severe crop injury will result if applications are made to soybeans that begun to crack through the soil surface or have emerged.
flumioxazin	71.4 g/ha		• Do NOT within 100 metres of non-dormant pears.
			• Do NOT tank-mix with DUAL II MAGNUM, BOUNDARY or FRONTIER MAX.
			• Any tillage operation performed after application will reduce weed control.
			• Apply only once per growing season.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.15–1.75 L/ha	0.46–0.7 L/ac	• Apply PP, PPI or PRE.
s-metolachlor/benoxacor	1.05–1.6 kg/ha		• Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i> , page 77 for more information.
			• Control of yellow nutsedge is obtained when DUAL II MAGNUM is applied PPI.
			• Optimal control of nightshade is obtained when DUAL II MAGNUM is applied PRE.
			• Do NOT use on muck, peat or high organic matter soils.
			• Use the higher rate of (DUAL II MAGNUM) for heavier weed populations.
			• Incorporation depth should not exceed 10 cm.

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
FRONTIER (900 g/L)	1.1–1.4 L/ha	0.44–0.56 L/ac	• Apply PP, PPI or PRE. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • Use higher rate for heavier weed pressure, for the control of nightshade and pigweed (PPI or PRE only) or on fine textured or high organic matter soils. • Control of nutsedge is achieved by applying FRONTIER preplant incorporated. • Minimum rate for preplant incorporated treatments is 0.5 L/ac. • Incorporation depth should not exceed 10 cm.
dimethenamid	1–1.25 kg/ha		
FRONTIER MAX (720 g/L)	756–963 mL/ha	302–385 mL/ac	• Refer to precautionary statements for FRONTIER. • Minimum rate for preplant incorporated treatments is 344 mL/ac. • Soybeans should be seeded at least 4 cm deep or crop injury may result.
dimethenamid	544–693 g/ha		
TREFLAN (480 g/L) or RIVAL (500 g/L) or BONANZA 400 (400 g/L)	1.25–2.4 L/ha 1.2–2.3 L/ha 1.5–2.75 L/ha	0.5–0.96 L/ac 0.48–0.92 L/ac 0.6–1.1 L/ac	• Apply PPI. • Conduct first incorporation as soon as possible after application, may be delayed up to 8–24 hours. Second incorporation is recommended anytime before planting.
trifluralin	0.6–1.155 kg/ha		
Soil Applied Broadleaf Herbicides			
FIRSTRATE (84 WG)	41.7 g/ha	17 g/ac	• Apply PRE. • Apply in both conventional and conservation tillage systems. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
cloransulam-methyl	35 g/ha		
LOROX L (480 g/L)	2.25–4.5 L/ha	0.9–1.8 L/ac	• Apply PRE. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • Do NOT use on sands (less than 2%–3% organic matter). • Plant soybeans at least 4 cm deep. • Heavy rainfall and adverse weather conditions may result in temporary crop injury. • Use higher rate for muck soils and clay soils.
linuron	1.13–2.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
SENCOR 75 DF (75 WG) metribuzin	0.75–1.5 kg/ha 0.56–1.12 kg/ha	0.3–0.6 kg/ac	• Apply PP, PPI or PRE. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • Do NOT use on sandy or coarse soils with less than 2% organic matter. • Use the recommended rate for each soil types (see label), otherwise crop injury may occur. • Excessive rainfall and adverse weather conditions may result in crop injury. • Plant soybeans at least 4 cm deep. • For preplant applications: – apply up to 30 days prior to seeding the crop. – use the higher rate when weeds are dense and are on soils with high organic matter (over 4%) and on soils with high clay content. – if emerged weeds are taller than 4 cm, apply in tank-mix with glyphosate. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
VALTERA (51.1%) flumioxazin	114 g/ha 71.4 g/ha	56 g/ac	• Apply to coarse and medium textured soils. • Apply to soybeans prior to planting or within 3 days after planting but prior to soybean emergence. • Severe crop injury will result if applications are made to soybeans that begun to crack through the soil surface or have emerged. • Do NOT within 100 metres of non-dormant pears. • Do NOT tank-mix with DUAL II MAGNUM, BOUNDARY or FRONTIER MAX. • Any tillage operation performed after application will reduce weed control. • Apply only once per growing season.
Soil Applied Grass and Broadleaf Herbicides			
BOUNDARY ¹ (DUAL MAGNUM SOYBEAN + SENCOR DF SOYBEAN) s-metolachlor + metribuzin	1.15–1.75 L/ha + 0.575–0.87 kg/ha 1.05–1.60 kg/ha + 0.43–0.653 kg/ha	0.46–0.7 L/ac + 0.233–0.53 kg/ac	• Apply PP or PRE. • Under preplant uses, a tank-mixture with glyphosate may be used to control emerged weeds. • Do NOT apply to coarse textured soils with less than 2% organic matter. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
BROADSTRIKE DUAL MAGNUM (924.7 g/L) flumetsulam/metolachlor	1.56 L/ha 1.44 kg/ha	0.624 L/ac	• Apply PP, PPI or PRE. For PPI treatments uniformly incorporate with equipment set to work at a depth of 5–8 cm. • For PP treatments in minimum or no-till systems apply up to 21 days before planting. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • Do NOT apply to areas where the soil pH is greater than 7.8 and organic matter less than 2%. • Do NOT apply to soils containing more than 5% organic matter. • Sufficient rainfall to moisten the soil to a depth of 5 cm should be received within 7–10 days for optimum weed control. • This formulation separates into two phases over time. Shake container before using. • Some rotational cropping restrictions apply (see Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
COMMAND 360 ME (360 g/L) clomazone	1.6–2.35 L/ha 0.576–0.846 kg/ha	0.64–0.94 L/ac	• Do NOT use on Natto soybeans. • Apply PRE. • Do NOT incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha. • For medium textured soils – Apply COMMAND at 2.3 L/ha. • For heavy textured soils – Apply COMMAND at 2.35 L/ha. • Control of yellow foxtail is achieved when COMMAND is applied at 2.3 to 2.35 L/ha. • Some rotational cropping restrictions apply (see Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
CONQUEST LQ ¹ (PURSUIT (240 g/L) + SENCOR 480 F (480 g/L)) imazethapyr + metribuzin	0.312–0.42 L/ha + 0.625–0.833 L/ha 0.075–0.1 kg/ha + 0.3–0.4 kg/ha	0.125–0.168 L/ac + 0.25–0.33 L/ac	• Apply PPI or PRE. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • For use on medium and heavy textured soils only. • Use higher rates for heavier weed pressure, for fine textured soils or soils high in organic matter. • See PURSUIT, page 170, for additional comments.

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
PURSUIT (240 g/L) imazethapyr	0.312–0.42 L/ha 0.075–0.1 kg/ha	0.125–0.168 L/ac	• Apply PP, PPI or PRE. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • Some rotational cropping restrictions apply (see Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61). • Addition of non-ionic surfactant and liquid fertilizer is required if emerged weeds are present at application. • For preplant applications: – apply Pursuit at 0.168 L/ac. – apply up to 30 days prior to planting. – for minimum tillage, only 1 working of the soil to prepare a seedbed is recommended following application. Make this final seedbed preparation no deeper than 10 cm and do not turn untreated soil to the surface. • For preplant incorporated applications apply Pursuit at 0.125 L/ac. • For preemergence applications, heavy infestations of, ragweed and/or barnyard grass require a tank-mix. • For preplant incorporated applications heavy infestations of lamb's-quarters, ragweed or barnyard grass may require a tank-mix. • Do NOT apply as preplant incorporated application more than 1 year in sequence. • Use only once per season.
VALOR ((1:14.5) 342 g/L) imazethapyr/pendimethalin	3.4 L/ha 1.165 kg/ha	1.36 L/ac	• Apply PPI. • Allow 24 months between applications. • See Pursuit, directly above, for additional comments. • Refer to Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61 for rotation restrictions.
Soil Applied Tank-Mix Options			
BOUNDARY ¹ (DUAL MAGNUM SOYBEAN + SENCOR DF SOYBEAN) plus LOROX L (480 g/L) s-metolachlor + metribuzin plus linuron	1.15–1.33 L/ha + 0.565–0.665 kg/ha 1.75–2 L/ha 1.05–1.60 kg/ha + 0.43–0.653 kg/ha 0.84–0.96 kg/ha	0.46–0.55 L/ac + 0.23–0.27 kg/ac 0.71–0.81 L/ac	• Apply PRE. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6. <i>Preplant & Postharvest Weed Control</i>, page 77 for more information. • Do NOT apply to coarse textured soils with less than 2% organic matter.

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
COMMAND 360 ME (360 g/L) plus DUAL II MAGNUM (915 g/L)	1.6–2.35 L/ha 1.75 L/ha	0.64–0.94 L/ac 0.7 L/ac	• Do NOT use on Natto soybeans. • Apply PRE. • Do NOT incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha. • For medium textured soils – Apply COMMAND at 2.3 L/ha. • For heavy textured soils – Apply COMMAND at 2.35 L/ha. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
clomazone plus s-metolachlor/benoxacor	0.576–0.846 kg/ha 1.6 kg/ha		
COMMAND 360 ME (360 g/L) plus LOROX L (480 g/L)	1.6–2.35 L/ha 2–2.25 L/ha	0.64–0.94 L/ac 0.8–0.9 L/ac	• Do NOT use on Natto soybeans. • Apply PRE. • Do NOT incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha and LOROX L at 2 L/ha. • For medium textured soils – Apply COMMAND at 2.3 L/ha and LOROX L at 2.25 L/ha. • For heavy textured soils – Apply COMMAND at 2.35 L/ha and LOROX L at 2.25 L/ha. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
clomazone plus linuron	0.576–0.846 kg/ha 0.96–1.080 kg/ha		
COMMAND 360 ME (360 g/L) plus PURSUIT (240 g/L)	1.6–2.35 L/ha 0.312 L/ha	0.64–0.94 L/ac 0.125 L/ac	• Do NOT use on Natto soybeans. • Apply PRE. • Do NOT incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha. • For medium textured soils – Apply COMMAND at 2.3 L/ha. • For heavy textured soils – Apply COMMAND at 2.35 L/ha. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
clomazone plus imazethapyr	0.576–0.846 kg/ha 0.075 kg/ha		
COMMAND 360 ME (360 g/L) plus SENCOR 75 DF (75 WG)	1.6–2.35 L/ha 0.375–0.530 kg/ha	0.64–0.94 L/ac 0.15–0.212 kg/ac	• Do NOT use on Natto soybeans. • Apply PRE. • Do NOT incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha and SENCOR at 0.375 kg/ha. • For medium textured soils – Apply COMMAND at 2.3 L/ha and SENCOR at 0.530 kg/ha. • For heavy textured soils – Apply COMMAND at 2.35 L/ha and SENCOR at 0.530 kg/ha. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
clomazone plus metribuzin	0.576–0.846 kg/ha 0.281–0.398 kg/ha		
DUAL II MAGNUM (915 g/L) plus LOROX L (480 g/L)	1.15–1.75 L/ha 1.77–2.39 L/ha	0.46–0.7 L/ac 0.71–0.96 L/ac	• Apply PRE. • Can be tank-mixed with GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.
s-metolachlor/benoxacor plus linuron	1.05–1.6 kg/ha 0.85–1.15 kg/ha		
DUAL II MAGNUM (915 g/L) plus SENCOR 75 DF (75 WG)	1.15–1.75 L/ha 0.55–1.5 kg/ha	0.46–0.7 L/ac 0.22–0.6 kg/ac	• Apply PPI or PRE. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i>, page 77 for more information.
s-metolachlor/benoxacor plus metribuzin	1.05–1.6 kg/ha 0.41–1.13 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69)
DUAL II MAGNUM (915 g/L) plus PURSUIT (240 g/L)	1.15–1.75 L/ha 0.312–0.42 L/ha	0.46–0.7 L/ac 0.125–0.168 L/ac	• Apply PP or PRE. • Maximum Pursuit rate for PPI treatments is 0.312 L/ha.
<i>s-metolachlor/benoxacor</i> plus <i>imazethapyr</i>	1.05–1.6 kg/ha 0.075–0.1 kg/ha		
FRONTIER (900 g/L) plus SENCOR 75 DF (75 WG)	1.25–1.4 L/ha 0.55–0.75 kg/ha	0.5–0.56 L/ac 0.22–0.3 kg/ac	• Apply PPI.
<i>dimethenamid</i> plus <i>metribuzin</i>	1.125–1.25 kg/ha 0.4–0.502 kg/ha		
FRONTIER (900 g/L) plus PURSUIT (240 g/L)	1.1–1.4 L/ha 0.312–0.42 L/ha	0.44–0.56 L/ac 0.125–0.168 L/ac	• Apply PRE.
<i>dimethenamid</i> plus <i>imazethapyr</i>	1–1.25 kg/ha 0.075–0.1 kg/ha		
FRONTIER MAX (720 g/L) plus PURSUIT (240 g/L)	756–963 mL/ha 0.312–0.42 L/ha	302–385 mL/ac 0.125–0.168 L/ac	• Apply PRE.
<i>dimethenamid</i> plus <i>imazethapyr</i>	544–693 g/ha 0.075–0.1 kg/ha		
PURSUIT (240 g/L) plus FIRST RATE (84 WG)	0.312 L/ha 20.8 g/ha	0.125 L/ac 8.5 g/ac	• Apply PRE. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, <i>Preplant & Postharvest Weed Control</i> , page 77 for more information.
<i>imazethapyr</i> plus <i>cloransulam-methyl</i>	75 g/ha 17.5 g/ha		
PURSUIT (240 g/L) LOROX L (480 g/L)	0.312–0.42 L/ha 1.77–2.39 L/ha	0.125–0.168 L/ac 0.71–0.96 L/ac	• Apply PRE.
<i>imazethapyr</i> plus <i>linuron</i>	0.075–0.1 kg/ha 0.85–1.15 kg/ha		
PURSUIT (240 g/L) plus SENCOR 75 DF (75 WG)	0.31–0.42 L/ha 0.53–1.5 kg/ha	0.125–0.168 L/ac 0.21–0.6 kg/ac	• Apply PPI or PRE. • For preplant applications the maximum Sencor rate is 1.3 kg/ha.
<i>imazethapyr</i> plus <i>metribuzin</i>	0.075–0.1 kg/ha 0.4–1.13 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69)
PURSUIT (240 g/L) plus TREFLAN (480 g/L) or RIVAL (500 g/L) or BONANZA 400 (400 g/L)	0.312 L/ha 1.25–2.4 L/ha 1.2–2.3 L/ha 1.5–2.75 L/ha	0.125 L/ac 0.5–0.96 L/ac 0.48–0.92 L/ac 0.6–1.1 L/ac	• Apply PPI.
imazethapyr plus trifluralin	0.075 kg/ha 0.6–1.155 kg/ha		
SENCOR 75 DF (75 WG) plus LOROX L (480 g/L)	0.44–1 kg/ha 1.04–2.5 L/ha	0.18–0.4 kg/ac 0.42–1 L/ac	• Apply PRE.
metribuzin plus linuron	0.33–0.75 kg/ha 0.5–1.2 kg/ha		
TREFLAN EC (480 g/L) or RIVAL (500 g/L) or BONANZA 400 (400 g/L) plus SENCOR 75 DF (75 WG)	1.25–2.4 L/ha 1.2–2.3 L/ha 1.5–2.75 L/ha 0.56–0.73 kg/ha	0.5–0.96 L/ac 0.48–0.92 L/ac 0.6–1.1 L/ac 0.22–0.29 kg/ac	• Apply PPI.
trifluralin plus metribuzin	0.6–1.155 kg/ha 0.42–0.55 kg/ha		
Postemergence Grass Herbicides			
ASSURE II (96 g/L) plus SURE-MIX	0.38–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac 5 L/1,000 L	• Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and volunteer corn and quackgrass in the 2–6 leaf stage. • Use the 0.38 L/ha (0.15 L/ac) rate of ASSURE II for control of volunteer corn, volunteer cereals, long spined sandbur and green foxtail. • The 0.5 L/ha (0.2 L/ac) rate of ASSURE II will suppress quackgrass and also control barnyard grass. • Use the 0.75 L/ha (0.3 L/ac) rate of ASSURE II for control of quackgrass. • Do NOT apply to soybeans within 80 days of harvest.
quizalofop-p-ethyl plus oil concentrate	0.036–0.072 kg/ha 0.5% v/v		
EXCEL SUPER (80.5 g/L)	0.67 L/ha	0.27 L/ac	• Apply to emerged annual grasses in the 1–6 leaf stage, which are actively growing while crop is small enough to permit thorough coverage. • A second application may be necessary to control later emerging grasses.
fenoxaprop-p-ethyl	0.054 kg/ha		
POAST ULTRA (450 g/L) plus ASSIST or MERGE	0.32–0.47 L/ha 2 L/ha 1 L/ha	0.13–0.19 L/ac 0.8 L/ac 0.4 L/ac	• Apply the 0.47 L/ha (0.19 L/ac) rate for wild oats or volunteer cereal control. • Apply POAST ULTRA to emerged grasses in the 1–6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. • Complete control is normally obtained 7–21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. • Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. • Water rates of 100–200 L/ha (40–80 L/ac) provide the best results.
sethoxydim plus oil concentrate or plus surfactant/solvent	0.15–0.2 kg/ha 2 L/ha 1 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
POAST ULTRA (450 g/L) plus MERGE	1.1 L/ha 1-2 L/ha	0.45 L/ac 0.4-0.8 L/ac	• Apply at 1-3 leaf stage of actively growing quackgrass in 110-200 L/ha (44-80 L/ac) water. • Thorough preplant tillage will result in more uniform quackgrass emergence. • Crop competition and inter-row cultivation 7-14 days after application will assist in quackgrass control for 6-8 weeks.
sethoxydim plus surfactant/solvent	0.5 kg/ha 1-2 L/ha		
SELECT (240 g/L) plus AMIGO	0.125-0.375 L/ha 5-10 L/1,000 L	0.05-0.15 L/ac 5-10 L/1,000 L	• Soybeans are tolerant at any growth stage. • Apply when annual grasses and volunteer cereals are in the 2-6 leaf stage. • Use the higher rate for quackgrass control. Apply to quackgrass in the 2-5 leaf stage. • Add the surfactant AMIGO at 5 L/1,000 L of spray solution to the low herbicide rate and 10 L/1,000 L of spray solution to the high herbicide rate for quackgrass control.
clethodim plus surfactant	0.03-0.09 kg/ha 0.5-1% v/v		
VENTURE L (125 g/L)	0.6 L/ha	0.243 L/ac	• This rate is for the control of volunteer corn only. • Apply at the 2-5 leaf stage of volunteer corn.
fluzifop-P-butyl	0.075 kg/ha		
VENTURE L (125 g/L)	1-2 L/ha	0.4-0.8 L/ac	• Apply at the 2-4 leaf stage of annual grasses and the 3-5 leaf stage of quackgrass or wirestem muhly. Use the 2 L/ha rate of VENTURE for wirestem muhly.
fluzifop-P-butyl	0.125-0.25 kg/ha		
Postemergence Broadleaf Herbicides			
BASAGRAN FORTÉ (480 g/L)	1.75-2.25 L/ha	0.7-0.9 L/ac	• Apply when soybeans are in unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. • Temporary crop injury may occur under abnormally hot, humid conditions. • Cool weather or drought may delay control. • For improved and more consistent control of velvetleaf and lamb's-quarters, 10 L/ha of 28% urea ammonium nitrate (UAN) or 6 L/ha of liquid ammonium sulphate may be added. The addition of either nitrogen source may cause slight leaf burn, but new growth is normal and crop vigour is not reduced. • Use the higher rate of BASAGRAN FORTÉ when weed pressure is high, weeds are large or conditions for activity are unfavourable.
bentazon	0.84-1.08 kg/ha		
BLAZER (240 g/L)	2.5 L/ha	1 L/ac	• Apply to emerged weeds up to 10 cm in height (refer to labels for weed heights) when soybeans are in the 1-3 trifoliate leaf stage. • Do NOT apply before the first trifoliate leaf stage of the soybeans. • Good spray coverage on the weeds is important for good weed control. • Soybeans may exhibit speckling, bronzing and/or leaf burn. The trifoliate leaf emerging at the time of application may be distorted. Soybeans usually outgrow these conditions and continue to grow at a normal rate with no adverse effect on vigour, maturity, or crop yield. • Do NOT apply BLAZER to soybeans that have been subjected to stress (see product label). • Do NOT add oils or surfactants to applications of BLAZER at 2.5 L/ha alone.
acifluorfen	0.6 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
BLAZER (240 g/L) plus ASSIST	1.25 L/ha 5 L/1,000 L	0.5 L/ac 5 L/1,000 L	• Apply to emerged redroot pigweed up to and including the 4 leaf stage and to common ragweed up to and including the 8 leaf stage when soybeans are in the 1–3 trifoliate leaf stage. • Do NOT apply before the first trifoliate leaf stage of the soybeans. • Good spray coverage on the weeds is important for good weed control. • Soybeans may exhibit speckling, bronzing and/or leaf burn. The trifoliate leaf emerging at the time of application may be distorted. Soybeans usually outgrow these conditions and continue to grow at a normal rate with no adverse effects on vigour, maturity or crop yield.
acifluorfen plus oil concentrate	0.3 kg/ha 0.5% v/v		
CLASSIC (25 DF) plus non-ionic surfactant	36 g/ha 2 L/1,000 L	14 g/ac 2 L/1,000 L	• Optimal timing for broadleaf control is when the soybeans are in the 1–3 trifoliate stage of growth. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. • Do NOT apply before the first trifoliate is fully expanded or after the initiation of flowering. • Addition of 28% UAN is recommended for improved control of velvetleaf. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
chlorimuron-ethyl plus non-ionic surfactant	9 g/ha 0.2% v/v		
FIRSTRATE (84 WG) plus non-ionic surfactant plus liquid fertilizer (28-0-0 or 32-0-0)	20.8 g/ha 2.5 L/1,000 L 25 L/1,000 L	8.5 g/ac 2.5 L/1,000 L 25 L/1,000 L	• Apply up to the 8 leaf stage for common ragweed and cocklebur, 6 leaf stage for giant ragweed, and 4 leaf stage for velvetleaf. • Apply any time prior to flowering stage of soybeans. • Application prior to full emergence of first trifoliate may cause temporary yellowing of soybeans.
cloransulam-methyl plus non ionic surfactant plus liquid fertilizer	17.5 g/ha 0.25% v/v 2.5% v/v		
PINNACLE (75 DF) plus non ionic surfactant	5.5–8 g/ha 1 L/1,000 L	2.2–3.2 g/ac 1 L/1,000 L	• Apply to emerged weeds up to 10 cm in height when soybeans have the 1st trifoliate leaf fully expanded. Applications may occur prior to the 1st trifoliate leaf stage if targeted weed species are at the maximum leaf stage for control. • Do NOT apply to soybeans, which have initiated flowering. • Use the higher rate for lamb's-quarters and velvetleaf. • The addition of UAN (28-0-0) at 4% v/v will enhance the control of velvetleaf.
thifensulfuron-methyl plus surfactant	4.1–6 g/ha 0.1% v/v		
REFLEX (240 g/L) plus TURBOCHARGE	1 L/ha 5 L/1,000 L	0.4 L/ac 5 L/1,000 L	• Apply early postemergence at 1–2 trifoliate to crop when weeds are small and actively growing (2–4 leaf stage). • Use 200–350 L/ha (80–140 L/ac) water. Use higher rates of water and pressure for a heavy weed or crop canopy. • Some bronzing may occur to soybean leaves at the time of application, but plants outgrow these effects without harming maturity or yield. • Do NOT apply REFLEX to any field more often than once every 2 years. • Do NOT apply to soybeans under stress. • Some rotational cropping restrictions apply (see Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
fomesafen plus mineral oil/surfactant	0.24 kg/ha 0.5% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Grass and Broadleaf Herbicides			
PURSUIT (240 g/L) plus non-ionic surfactant plus liquid fertilizer 28-0-0, 10-34-0, or 32-0-0	0.312–0.42 L/ha 2.5 L/1,000 L 2 L/ha	0.125–0.168 L/ac 2.5 L/1,000 L 0.8 L/ac	• Apply when the weeds are up to the 2 true leaf stage. • Some rotational cropping restrictions apply (see label and Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61). • Use only once per season.
imazethapyr plus non-ionic surfactant plus liquid fertilizer	0.075–0.1 kg/ha 0.25% v/v 2 L/ha		
CLEAN SWEEP ¹ (PURSUIT (240 g/L) + BASAGRAN FORTÉ (480 g/L) plus liquid fertilizer 28-0-0, 10-34-0 or 32-0-0	0.312 + 1.75 L/ha 2 L/ha	0.125 + 0.7 L/ac 0.8 L/ac	• Available as a co-pack containing PURSUIT and BASAGRAN FORTÉ. • Apply postemergence to actively growing weeds in the 2–6 leaf stage. • Some rotational cropping restrictions apply (see label and Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
imazethapyr/bentazon plus liquid fertilizer	0.075 + 0.84 kg/ha 2 L/ha		
Postemergence Tank-Mix Options			
ASSURE II (96 g/L) plus PINNACLE (75 DF) plus BASAGRAN FORTÉ (480 g/L) plus SURE-MIX	0.63 L/ha 5.5–8 g/ha 1.75–2.25 L/ha 5 L/1,000 L	0.25 L/ac 2.2–3.2 g/ac 0.7–0.9 L/ac 5 L/1,000 L	• Apply to soybeans from the 1–4 trifoliate leaf stage. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. • Do NOT apply to soybeans, which have initiated flowering. • If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control.
quizalofop-p-ethyl plus thifensulfuron-methyl plus bentazon plus oil concentrate	0.06 kg/ha 4.1–6 g/ha 0.84–1.08 kg/ha 0.5% v/v		
ASSURE II (96 g/L) plus PINNACLE (75 DF) plus SURE-MIX	0.5 L/ha 5.5–8 g/ha 5 L/1,000 L	0.2 L/ac 2.2–3.2 g/ac 5 L/1,000 L	• Apply to soybeans from the 1–3 trifoliate leaf stage. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. • Do NOT apply to soybeans that have initiated flowering. • If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. • Velvetleaf control may be reduced with a tank-mix application. • For optimum control, make separate applications of PINNACLE and ASSURE.
quizalofop-p-ethyl plus thifensulfuron-methyl plus oil concentrate	0.048 kg/ha 4.1–6 g/ha 0.5% v/v		

¹ Indicates product sold as a co-pack.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
ASSURE II (96 g/L) plus CLASSIC (25 DF) plus SURE-MIX	0.38–0.63 L/ha 36 g/ha 5 L/1,000 L	0.15–0.255 L/ac 14 g/ac 5 L/1,000 L	• Apply to soybeans from the 1–3 trifoliate leaf stage. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. • Do NOT apply to soybeans, which have initiated flowering. • If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. • If targeting yellow foxtail or quackgrass use ASSURE II at a rate of 0.63 L/ha.
quizalofop-p-ethyl plus chlorimuron-ethyl plus oil concentrate	0.036–0.060 kg/ha 9.0 g/ha 0.5–1.0%		
BLAZER (240 g/L) plus BASAGRAN FORTÉ (480 g/L)	1.25 L/ha 1.25 L/ha	0.5 L/ac 0.5 L/ac	• Use when common ragweed and/or redroot pigweed is the dominant weed(s).
acifluorfen plus bentazon	0.3 kg/ha 0.6 kg/ha		
BLAZER (240 g/L) plus BASAGRAN FORTÉ (480 g/L)	0.63 L/ha 1.75 L/ha	0.25 L/ac 0.7 L/ac	• Use when lamb's-quarter is the dominant weed.
acifluorfen plus bentazon	0.15 kg/ha 0.84 kg/ha		
EXCEL SUPER (80.5 g/L) plus BASAGRAN FORTÉ (480 g/L)	0.67 L/ha 1.75–2.25 L/ha	0.27 L/ac 0.7–0.9 L/ac	• If annual broadleaf and grassy weeds are not in the correct stage for a tank-mix application, use a split application at the correct stage for each product.
fenoxaprop-p-ethyl plus bentazon	0.054 kg/ha 0.84–1.08 kg/ha		
EXCEL SUPER (80.5 g/L) plus BASAGRAN FORTÉ (480 g/L) plus PINNACLE (75 DF)	0.67 L/ha 1.75–2.25 L/ha 5.5–8 g/ha	0.27 L/ac 0.7–0.9 L/ac 2.2–3.2 g/ac	• If broadleaf and grassy weeds are not in the correct stage for a tank-mix application, use a split application at the correct stage for each product.
fenoxaprop-p-ethyl plus bentazon plus thifensulfuron-methyl	0.054 kg/ha 0.84–1.08 kg/ha 4.1–6 g/ha		
EXCEL SUPER (80.5 g/L) plus PINNACLE (75 DF)	0.67 L/ha 5.5–8 g/ha	0.27 L/ac 2.2–3.2 g/ac	• If broadleaf and grassy weeds are not in the correct stage for a tank-mix application, use a split application at the correct stage for each product.
fenoxaprop-p-ethyl plus thifensulfuron-methyl	0.054 kg/ha 4.1–6 g/ha		
PINNACLE (75 DF) plus BASAGRAN FORTÉ (480 g/L)	5.5–8 g/ha 1.75–2.25 L/ha	2.2–3.2 g/ac 0.7–0.9 L/ac	• Apply to emerged weeds when soybeans have the 1st trifoliate leaf fully expanded. • Do NOT apply to soybeans that have initiated flowering. • If Canada thistle, yellow nutsedge and field bindweed are target species a 2nd application may be required.
thifensulfuron-methyl plus bentazon	4.1–6 g/ha 0.84–1.08 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
REFLEX (240 g/L) plus PINNACLE (75DF) plus AGRAL 90	1 L/ha 8 g/ha 2.5 L/1,000 L	0.4 L/ac 3.2 g/ac 2.5 L/1,000 L	• Apply early postemergence at the 2–4 leaf stage of weeds and 1–2 trifoliate stage of the crop.
fomesafen plus thifensulfuron-methyl plus non-ionic surfactant	0.24 kg/ha 6 g/ha 0.25% v/v		
REFLEX (240 g/L) plus VENTURE L (125 g/L) plus TURBOCHARGE	1 L/ha 0.6–2.0 L/ha 5 L/1,000 L	0.4 L/ac 0.243–0.8 L/ac 5 L/1,000 L	• Apply early postemergence at the 2–4 leaf stage of weeds and 1–2 trifoliate stage of the crop. • Apply in 200 L/ha (80 L/ac) water.
fomesafen plus fluazifop-p-butyl plus surfactant	0.24 kg/ha 6 g/ha 0.5% v/v		
PURSUIT (240 g/L) plus FIRSTRATE (84 WG) plus non-ionic surfactant plus liquid fertilizer (28-0-0 or 32-0-0)	0.312 L/ha 20.8 g/ha 2.5 L/1,000 L 2 L/ha	0.125 L/ac 8.5 g/ac 2.5 L/1,000 L 0.8 L/ac	• Apply when weeds are up to the 2 true leaf stage. • Use for control of annual grasses, lamb's-quarters and redroot pigweed.
imazethapyr plus cloransulan-methyl plus non-ionic surfactant plus liquid fertilizer	75 g/ha 17.5 g/ha 0.25% v/v 2 L/ha		
PURSUIT (240 g/L) plus REFLEX (240 g/L) plus AGRAL 90 plus liquid fertilizer	0.312 L/ha 0.8–1 L/ha 2.5 L/1,000 L 2 L/ha	0.125 L/ac 0.32–0.4 L/ac 2.5 L/1,000 L 0.8 L/ac	• Use the lower rate of REFLEX for ragweed only. • Use the higher rate of REFLEX for lamb's-quarters.
imazethapyr plus fomesafen plus non-ionic surfactant plus liquid fertilizer	0.075 kg/ha 0.19–0.24 kg/ha 0.25% v/v 2 L/ha		
VENTURE L (125 g/L) plus BASAGRAN (480 g/L) plus ASSIST	1–2 L/ha 1.75–2.25 L/ha 5 L/1,000 L	0.4–0.8 L/ac 0.7–0.9 L/ac 5 L/1,000 L	• Apply when soybeans are at the unifoliate to 3rd trifoliate stage and when weeds are small and actively growing. • Use the 0.8 L/ac rate of VENTURE L to control wirestem muhly. • Temporary crop injury may occur under abnormally hot and humid condition.
fluazifop-p-butyl plus bentazon plus oil concentrate	0.125–0.25 kg/ha 0.84–1.08 kg/ha 0.5% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Spot Treatments – see Chapter 6. *Preplant & Postharvest Weed Control*, page 77 for a list of options.

Wick Wiper and Roller Application – see Chapter 6. *Preplant & Postharvest Weed Control*, page 77 for a list of options.

Preharvest

AIM EC (240 g/L) plus non-ionic surfactant or MERGE	0.073–0.117 L/ha 2.5 L/1,000 L 10 L/1,000 L	30–47 mL/ac 2.5 L/1,000 L 10 L/1,000 L	• Apply to actively growing weeds, up to 10 cm. • Coverage of weed and crop foliage is essential for control. • Preharvest interval (PHI) is 3 days.
carfentrazone-ethyl plus non-ionic surfactant or MERGE	0.0175–0.028 kg/ha 0.25% v/v 0.1% v/v		
REGLONE DESICCANT (240 g/L) plus AGRAL 90	1.25–2.3 L/ha 1 L/1,000 L	0.5–0.92 L/ac 1 L/1,000 L	• Apply in 225 L/ha water to burn off weeds when 80% natural crop leaf defoliation has occurred and 80% of the pods have turned yellow. • Avoid regrowth by targeting spray within 7 days of variety maturity date and harvest 5–7 days after application. • For ground application use 1.25–1.7 L/ha (0.5–0.68 L/ac). • For aerial application use 1.7–2.3 L/ha (0.68–0.92 L/ac).
diquat plus surfactant	0.30–0.55 kg/ha 0.1% v/v		
glyphosate*	See Table 11-5	See Table 11-5	• Apply in 50–100 L/ha (20–40 L/ac) water when the crop is 30% grain moisture or less. • Do NOT apply to crops grown for seed. • Apply at least 7 days prior to harvest when pod tissue is dry and brown and 80–90% of original leaves have dropped.
glyphosate	0.9 kg/ha		

GLYPHOSATE TOLERANT (“ROUNDUP READY”) SOYBEAN

Weed Management Strategies for Glyphosate Tolerant Soybean

University of Guelph research trials have shown that when weed competition is high, two applications of glyphosate in glyphosate tolerant soybeans maximized yields and gross returns over 5 years at multiple locations in Ontario.

Time of Glyphosate Application	Weed Control (% visual)	Yield (%)
Preplant followed by a Post application at the 1–3 trifoliolate stage	96	100
Unifoliolate followed by a Post application at the 1–3 trifoliolate stage	96	98
Post at the 1–3 trifoliolate stage (no Preplant Burndown applied)	93	83

Source: Swanton and Deen, 1999, University of Guelph.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TABLE 11-3. Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans

Trade Name	Grasses								Annual Broadleaves										Perennials							Crop Tolerance	
	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	flabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
Preplant Burndown Herbicides																											
GUARDIAN ^{1,2} (Emerged Weeds)	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	8	9	7/8	5	8	8	9	8	9	G ²
Residual Weed Control	7	7	6	6 ^R	6 ^R	6	6	7	8	8	8	8	7 ^R	9	2	7 ^R	7	7	7	5	3	8	8	5	5	5	
glyphosate ² + VALTERA (Emerged Weeds)	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	8	9	7/8	5	8	8	9	8	9	G ²
Residual Weed Control	3	3	3	5	5	5	3	-	-	4	8	7	9	-	9	9	7	3	7	-	-	-	-	-	-	-	
Postemergence Grass and Broadleaf Herbicides for "Roundup Ready" (glyphosate tolerant) varieties only																											
glyphosate ² (Emerged Weeds)	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	8	9	7/8	5	8	8	9	8	9	E ²
Postemergence Tank-Mixes with Residual Weed Control for "Roundup Ready" (glyphosate tolerant) varieties only																											
GUARDIAN ^{1,2} (Emerged Weeds)	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	8	9	7/8	5	8	8	9	8	9	G ²
Residual Weed Control	7	7	6	6 ^R	6 ^R	6	6	7	8	8	8	8	7 ^R	9	2	7 ^R	7	7	7	5	3	8	8	5	5	5	
glyphosate ² + FIRSTRATE	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	8	9	7/8	5	8	8	9	8	9	E ²
Residual Weed Control	0	0	0	0	0	0	0	0	7	9 ^R	9	-	2	9	2	2	9 ^R	9	9	-	2	-	-	2	7	7	
glyphosate ² + PURSUIT	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	8	9	7/8	5	8	8	9	8	9	E ²
Residual Weed Control	-	-	8	-	-	-	-	8	-	-	-	-	8 ^R	-	9	9 ^R	-	-	8	0	0	0	-	0	0	0	

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.² Use only on certified soybean seed designated as "Roundup Ready" Soybean. See Table 11-5. Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean, page 182, for a complete list registered products.^R Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.**BOLD** numbers indicate the weed is listed on the product label for control or suppression.

TABLE 11-4. Additional Weed Control Ratings in Glyphosate Tolerant ("Roundup Ready") Soybean

Trade Name	Grasses		Annual and Biennial Broadleaf Weeds											Perennials		
	sandbur	vol. corn	beggarsticks, nodding	biennial wormwood	bur-cucumber	flower of an hour	prickly lettuce	spreading atriplex	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	violet, field	dandelion ³	horsenettle	wirestem muhly
Postemergence Grass and Broadleaf Herbicides																
glyphosate	9	9 ²	8	8	8	9	8	7/8	8	9	8*	-	-	8*	8*	8
GUARDIAN ^{1,2} (glyphosate + CLASSIC)	9	9 ²	8	8	8	9	8	7/8	8	9	8*	-	-	8	8*	8

* Higher rates of glyphosate (i.e. 1.35–1.8 kg/ha) are required to achieve control of these perennial weeds.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

² Glyphosate tolerant ("Roundup Ready") volunteer corn will not be controlled.

³ Dandelion must be less than 15 cm in diameter to achieve this level of control.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 11-5. Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean

	ACTIVE INGREDIENT RATE:			ASSURE II	EXCEL SUPER	POAST ULTRA	SELECT	VENTURE L	BLAZER	CLASSIC	FIRSTRATE	PINNACLE	PURSUIT	REFLEX
	0.9 kg/ha	1.35 kg/ha	1.8 kg/ha											
	EQUIVALENT PRODUCT RATE:													
CREDIT PLUS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓						✓			✓	
CREDIT 45 (450 g/L)	0.8 L/ac	1.2 L/ac	1.6 L/ac							✓				
FACTOR 540 (540 g/L)	0.67 L/ac	1 L/ac	1.34 L/ac	✓						✓			✓	
GLYFOS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓						✓			✓	
ROUNDUP ULTRA2 (540 g/L)	0.67 L/ac	1 L/ac	1.34 L/ac	✓				✓		✓			✓	
ROUNDUP WEATHERMAX (540 g/L)	0.67 L/ac	1 L/ac	1.34 L/ac	✓				✓		✓	✓		✓	
SHARPSHOOTER PLUS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac	✓						✓			✓	
TOUCHDOWN TOTAL (500 g/L)	0.72 L/ac	1.1 L/ac	1.44 L/ac							✓			✓	
VANTAGE PLUS (360 g/L)	1 L/ac	1.5 L/ac	2 L/ac							✓	✓			
VANTAGE PLUS MAX (480 g/L)	0.75 L/ac	1.13 L/ac	1.5 L/ac	✓						✓			✓	
WISEUP	1 L/ac	1.5 L/ac	2 L/ac							✓				

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23
and Chapter 5. *Notes on Adjuvants*, page 69).

Preplant Burndown Herbicides – Refer also to Chapter 6. *Preplant & Postharvest Weed Control*, page 77.

- Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one-pass" weed management program.
- Refer to Chapter 6. *Preplant & Postharvest Weed Control*, page 77 for preplant application rates for glyphosate and GRAMAXONE.
- It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. SENCOR, LOROX L) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.

CLEANSTART PLUS¹

CREDIT PLUS (360 g/L) +
AIM EC (240 g/L)

2.5 L/ha +
73 mL/ha

1.0 L/ac +
30 mL/ac

glyphosate +
carfentrazone-ethyl

0.9 kg/ha +
0.0175 kg/ha

- Apply to actively growing weeds, up to 10 cm.
- Coverage of weed foliage is essential for control.
- Only weeds emerged at application will be controlled.
- CLEANSTART PLUS¹ provides no residual weed control.
- CLEANSTART PLUS¹ is a co-pack of CREDIT PLUS and AIM EC.

¹ Indicates product sold as a co-pack.

* Numerous products exist, refer to Table 11-5. *Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean*, page 182, for a complete list along with registered tank-mix partners.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
GUARDIAN ¹ TOUCHDOWN TOTAL (500 g/L) + CLASSIC (25 DF)	1.8 L/ha + 36 g/ha	0.72 L/ac + 14 g/ac	• Apply as a PP burndown. • Some rotational restrictions apply (see CLASSIC label and Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61). • GUARDIAN is a co-pack of TOUCHDOWN TOTAL + CLASSIC. • Other glyphosate products can be tank-mixed with CLASSIC, see Table 11-5, <i>Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean</i>, page 182, for a complete list). • CLASSIC can only be applied once per growing season.
glyphosate + chlorimuron-ethyl	0.9 kg/ha + 9 g/ha		
glyphosate plus VALTERA (51.1%)	See Table 11-5 114 g/ha	See Table 11-5 56 g/ac	• Apply to coarse and medium textured soils. • Apply to soybeans prior to planting or within 3 days after planting but prior to soybean emergence. • Severe crop injury will result if applications are made to soybeans that begun to crack through the soil surface or have emerged. • Do NOT within 100 metres of non-dormant pears. • Do NOT tank-mix with DUAL II MAGNUM, BOUNDARY or FRONTIER MAX. • Any tillage operation performed after application will reduce weed control. • Apply only once per growing season.
glyphosate + flumioxazin	0.9 kg/ha + 71.4 g/ha		

Postemergence Grass and Broadleaf Herbicides, and Tank-Mixes – "Roundup Ready" (Glyphosate Tolerant) Varieties Only

glyphosate*	See Table 11-5	See Table 11-5	• For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans.
glyphosate	0.9 kg/ha		• Apply between the first trifoliolate leaf stage and the full flower stage of the soybeans. • Weeds are more easily controlled and weed competition avoided when applications are made when weeds are small, although weeds up to 25 cm tall will be controlled. • A second application may be made for later flushes emerging after the initial application. • Use 100–200 L/ha (40–80 L/ac) water.

Postemergence Grass and Broadleaf Herbicides, and Tank-Mixes – "Roundup Ready" (Glyphosate Tolerant) Varieties Only

glyphosate*	See Table 11-5	See Table 11-5	• For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans.
glyphosate	1.8 kg/ha		• Apply when milkweed, perennial sow-thistle and Canada thistle are 15–60 cm and nutsedge is 5–15 cm in height and actively growing for best results.
glyphosate* plus ASSURE II (96 g/L)	See Table 11-5 0.25 L/ha	See Table 11-5 0.1 L/ac	• For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans. • The addition of ASSURE II is to control volunteer "Roundup Ready" corn. • Apply to volunteer corn up to 30 cm (12") in height. • Do NOT apply to soybeans within 80 days of harvest. • SUREMIX may or may not be added to this tank-mix. If adding SUREMIX do so at a rate of 5 L/1,000 L water.
glyphosate plus quizalofop-p-ethyl	0.9–1.8 kg/ha 0.024 kg/ha		

¹ Indicates product sold as a co-pack.

* Numerous products exist, refer to Table 11-5, *Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean*, page 182, for a complete list along with registered tank-mix partners.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
glyphosate* plus FIRSTRATE (84 WG)	See Table 11-5 20.8 g/ha	See Table 11-5 8.5 g/ac	- For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans. - The addition of FIRSTRATE will provide residual control of common ragweed, velvetleaf, cocklebur, jimsonweed and giant ragweed. Do NOT apply to soybeans within 65 days of harvest.
glyphosate plus cloransulam-methyl	0.45–0.9 kg/ha 17.5 g/ha		
glyphosate* plus VENTURE (125 g/L)	See Table 11-5 0.6 L/ha	See Table 11-5 0.243 L/ac	- For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans. - The addition of VENTURE is needed to control volunteer "Roundup Ready" corn. - Apply to volunteer corn at the 2–5 leaf stage.
glyphosate plus fluazifop-p-butyl	0.9–1.8 kg/ha 0.075 kg/ha		
glyphosate* plus PURSUIT (240 g/L)	See Table 11-5 0.16–0.21 L/ha	See Table 11-5 0.065–0.085 L/ac	- For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans. - Apply up to the 3rd trifoliate stage of soybean. - Use only once per season. - Some rotational cropping restrictions apply (see PURSUIT label and Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
glyphosate plus imazethapyr	0.9–1.8 kg/ha 0.038–0.05 kg/ha		
GUARDIAN ¹ TOUCHDOWN TOTAL (500 g/L) + CLASSIC (25 DF)	1.8 L/ha + 36 g/ha	0.72 L/ac + 14 g/ac	- For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans. - Apply up to the 3rd trifoliate stage of soybean. - Use only once per season. - Other glyphosate products can be tank-mixed with CLASSIC, see Table 11-5, <i>Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean</i>, page 182, for a complete list). - Some rotational cropping restrictions apply (see CLASSIC label and Table 4-4, <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61).
glyphosate plus chlorimuron-ethyl	0.9 kg/ha 9 g/ha		
Postemergence Grass and Broadleaf Herbicides, and Tank-Mixes – "Roundup Ready" (Glyphosate Tolerant) Varieties Only			
glyphosate*	See Table 11-5	See Table 11-5	For use only with pedigreed (certified) soybean seed designated as "Roundup Ready" Soybeans.
glyphosate	0.9 + 0.9 kg/ha		- Sequential applications are desirable when there are perennial weeds emerging over a long period of time (i.e. sow-thistle, Canada thistle). - For best results, apply the second application 14 days after the first. - Apply when milkweed, perennial sow-thistle and Canada thistle are 15–60 cm and nutsedge is 5–15 cm in height and actively growing for best results.
Preharvest			
glyphosate*	See Table 11-5	See Table 11-5	- Apply in 50–100 L/ha (20–40 L/ac) water when the crop is 30% grain moisture or less. Do NOT apply to crops grown for seed.
glyphosate	0.9 kg/ha		Apply at least 7 days prior to harvest when pod tissue is dry and brown and 80–90% of original leaves have dropped.

¹ Indicates product sold as a co-pack.

* Numerous products exist, refer to Table 11-5, *Glyphosate Products and "Two-Way" Postemergence Tank-Mixes For Use on Glyphosate Tolerant Soybean*, page 182, for a complete list along with registered tank-mix partners.

GLUFOSINATE TOLERANT ("LIBERTY LINK") SOYBEAN

Weed Management Strategies for Glufosinate Tolerant Soybean

Strategies for weed management in glufosinate tolerant soybeans are similar to those outlined for *Glyphosate Tolerant ("Roundup Ready") Soybean*, on page 179.

TABLE 11-6. Herbicide Weed Control Ratings in Glufosinate Tolerant ("Liberty Link") Soybeans

Trade Name	Grasses								Annual Broadleaves										Perennials							Crop Tolerance	
	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	buckwheat, wild	cocklebur	fleabane, Canada	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle		thistle, Canada
Postemergence Grass and Broadleaf Herbicides, and Tank-Mixes – “Liberty Link” (glufosinate tolerant) varieties only																											
LIBERTY (Emerged Weeds)	9	9	9	9	9	8/9	9	9	8	9	7	8/9	8	9	9	9	9	8	8	6	6	-	6	6/7	8	7	E
LIBERTY + BASAGRAN FORTÉ (Emerged Weeds)	9	9	9	9	9	8/9	9	9	8	9	7	9	8	9	9	9	9	6	8	6	6	-	8	6/7	8	7	G
LIBERTY + PURSUIT (Emerged Weeds)	9	9	9	9	9	9	9	9	8	9	7	9	8	9	9	9	9	6	8	6	6	-	7	6/7	8	7	G
Residual Weed Control	8	7	7	9 ^R	9 ^R	9	8	7	8	7 ^R	2	9	8 ^R	9	9 ^R	9 ^R	8 ^R	6	9	2	2	2	4	2	2	2	

* The high rate or a sequential application will be needed to achieve this level of control.

° PPI timing is required to achieve this level of control.

- Insufficient information available to make a rating.

¹ Indicates herbicides sold as a co-pack under this trade name.

^R Indicates populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Preplant Burndown Herbicides – Refer also to Chapter 6. *Preplant & Postharvest Weed Control*, page 77.

- Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a “one-pass” weed management program.
- Refer to Chapter 6. *Preplant & Postharvest Weed Control*, page 77 for preplant application rates for glyphosate and GRAMAXONE.
- It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. SENCOR, LOROX L) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.

“One-Pass” Strategies

LIBERTY 200 SN (200 g/L)	2.5 L/ha	1 L/ac	• Use ONLY on soybean varieties that are tolerant to LIBERTY 200 SN. • LIBERTY 200 SN can be applied from the cotyledon to flowering stage of soybean. • LIBERTY 200 SN is a contact herbicide and has no residual activity. • Ammonium sulphate can be applied at 6 L/ha (2.4 L/ac) (liquid) or 3.3 kg/ha (1.3 kg/ac) (dry) for improved control of specific weeds. • Do NOT add oil or any other surfactants.
<i>glufosinate ammonium</i>	0.5 kg/ha		
LIBERTY 200 SN (200 g/L)	2.5 L/ha	1 L/ac	• Use ONLY on soybean varieties that are tolerant to LIBERTY 200 SN. • This tank-mix can be applied can be applied from the cotyledon to flowering stage of soybean. • This tank-mix consists of contact herbicides that have no residual activity. • Weeds should be targeted when small and actively growing (8 leaf stage or less).
plus BASAGRAN FORTÉ (480 g/L)	1.75 L/ha	0.7 L/ac	
<i>glufosinate ammonium</i>	0.5 kg/ha		
<i>plus bentazon</i>	0.84 kg/ha		
LIBERTY 200 SN (200 g/L)	2.5 L/ha	1 L/ac	• Use ONLY on soybean varieties that are tolerant to LIBERTY 200 SN. • This tank-mix can be applied can be applied from the cotyledon to flowering stage of soybean. • The addition of PURSUIT is for residual activity of labeled grass and broadleaf weeds. • Weeds should be targeted when small and actively growing (8 leaf stage or less).
plus PURSUIT(240 g/L)	0.312 L/ha	0.125 L/ac	
<i>glufosinate ammonium</i>	0.5 kg/ha		
<i>imazethapyr</i>	0.075 kg/ha		

“Two-Pass” Strategies

LIBERTY 200 SN (200 g/L)	2.5 L/ha	1 L/ac	• Use ONLY on soybean varieties that are tolerant to LIBERTY 200 SN. • LIBERTY 200 SN can be applied from the cotyledon to flowering stage of soybean. • Do NOT apply more than 4.5 L/ha (1.8 L/ac) per season. • Ideally, the first application is made between the uni-foliolate and 2nd trifoliolate stage of soybean, the second application is made between the 4th and 6th trifoliolate stage of soybean.
followed by LIBERTY 200 SN (200 g/L)	2 L/ha	0.8 L/ac	
<i>glufosinate ammonium</i>	0.5 kg/ha		
<i>glufosinate ammonium</i>	0.4 kg/ha		

TABLE 11-7. Maximum Weed Stage² for Postemergence Soybean Herbicides

Trade Name	Application Window (soybean stage) ¹	Annual Grasses									Annual Broadleaf										Perennials			
		barnyard grass	crabgrass	fall panicum	green foxtail	yellow foxtail	witchgrass	proso millet	volunteer corn	volunteer wheat	buckwheat, wild	cocklebur	johnsonweed	lady's-thumb	lamb's-quarters	wild mustard	nightshade	pigweed	common ragweed	giant ragweed	velvetleaf	quackgrass control	quackgrass suppression*	wirestem muhly
ASSURE II rate mL/ac		2-ET 200		2-ET 200	2-ET 150	2-ET 200	2-ET 200	2-ET 200	2-6 150	2-ET 150												300	200	
EXCEL SUPER rate mL/ac		1-6 268	1-6 268	1-6 268	1-6 268	1-6 268	1-6 268	1-6 268	1-6 268															
POAST ULTRA rate mL/ac		1-6 130- 190	1-6 130- 190	1-6 130- 190	1-6 130- 190	1-6 130- 190	1-6 130- 190	1-6 130- 190	1-6 130- 190														1-3 450	
SELECT rate mL/ac		2-6 75	2-6 75	2-6 75	2-6 75	2-6 75	2-6 75	2-6 75	2-6 75	2-4 50												150	75	
VENTURE L rate mL/ac		2-5 320	2-5 400	2-5 400	2-4 400	2-4 400	2-5 400	2-4 400	2-4 240	2-5 320												3-5 800	3-5 400	3-5 800
BASAGRAN ² rate L/ac	uni to 2-tri										10 0.9**	10 0.9	10 0.9**	8 0.9	10 0.9**			4 0.9	6 0.9	4 0.9	6 0.9**			
BLAZER rate L/ac	1 to 3-tri										4 1	10 1	8 1	2 1	10 1	6 1		4-6 0.5:1	8 0.5:1					
CLASSIC	1 to 3-tri																	2-8	2-6		2-4			
CLEANSWEEP	uni to 2-tri	6			4	4					6		6	6	6	4		12	6		4			
FIRSTRATE rate g/ac	prior to flowering										4-8 8.5	2-4 8.5							4-8 8.5	4-6 8.5	2-4 8.5			
PINNACLE rate g/ac	1-tri to flowering												2-8 2.2	2-6 3.2	2-8 2.2			2-8 2.2			2-4 3.2			
PURSUIT		6			4	4	2				2	2				2	2	12	2		8			
REFLEX	1 to 2-tri										4		4	3*	4	4	4	4	4		3*			
LIBERTY ³	until flowering	5	5	4	5	4	4	5			4	4	6	6	4	5	6	5		4			4	
glyphosate ⁴	until flowering	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8			4+		

Leaf stage abbreviations: ET – early tillering of grasses; c – cotyledon stage; uni – unifoliate;

tri – trifoliate.

* Suppression only.

**Lower rates have lower leaf stage.

¹ Expressed as leaf stages except as indicated.

² Maximum leaf stage for control.

³ Use only on "Liberty Link" varieties.

⁴ Use only on "Roundup Ready" varieties. See Table 11-5. *Glyphosate Products and "Two-Way" Postemergence Tank Mixes For Use on Glyphosate Tolerant Soybean*, page 182, for a complete list.



12. OTHER FIELD CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 12-1. Canola, Flax, Millet, Mustard, Sorghum, Sunflower Herbicide Weed Control Ratings

Trade Name	Crop					Annual Grasses										Annual Broadleaves										Perennials												
	canola	flax	mustard	sorghum and millet	sunflowers	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	wild oats	vol. corn	vol. wheat	vol. barley	buckwheat, wild	cocklebur	fleabane, Canada	lady's-thumb	lamb's-quarters	wild mustard	nightshades, annual	pigweed	ragweed, common	ragweed, giant	velvetleaf	field bindweed	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada			
Soil Applied Grass Herbicides																																						
EPTAM	✓			✓		9	9	9	9	9	9	9	7	8	-	-	-	4	2	0	7	7	5	7	7	5	3	5	-	-	-	8	5	-	-			
TREFLAN or BONANZA or RIVAL	✓		✓	✓		9	9	9	9	9	9	9	7	8	-	-	-	5	2	0	2	8	2	2	8	2	2	2	2	2	2	2	2	2	2			
Postemergence Grass Herbicides																																						
ASSURE II	✓	✓				9	8	9	9	9	8	9	9	-	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0			
EXCEL SUPER	✓					9	8	9	9	9	9	9	9	-	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0			
POAST ULTRA	✓	✓	✓		✓	9	8	9	9	9	9	9	9	8	8	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0			
SELECT	✓	✓		✓		9	8	9	9	9	9	9	9	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0			
VENTURE L	✓					9	8	9	8	8	8	9	8	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0			
Postemergence Broadleaf Herbicides																																						
BASAGRAN		✓		✓		0	0	0	0	0	0	0	0	0	0	0	0	7	9	5	9	7	9	7	7	8	6	9	6	2	2	8	0	6	7			
BUCTRIL M or BADGE or LOGIC M or MEXTROL		✓				0	0	0	0	0	0	0	0	0	0	0	0	9	8	-	9	9	9	9	8	9	-	9	7	6	0	0	0	7	7			

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

- Insufficient information available to make a rating.

✓ Can be used on this crop.

BOLD numbers indicates the weed is listed on the product label for control or suppression.

¹ Use only on crops planted with certified canola seed designated as "Liberty Link" Canola.

² Use only on crops planted with certified canola seed designated as "Pursuit Tolerant" Canola.

³ Use only on crops planted with certified canola seed designated as "Roundup Ready" Canola. See Table 4-3. *Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops*, page 60 for a complete list of registered products.

TABLE 12-1. Canola, Flax, Millet, Mustard, Sorghum, Sunflower Herbicide Weed Control Ratings (cont'd)

Trade Name	Crop					Annual Grasses										Annual Broadleaves										Perennials												
	canola	flax	mustard	sorghum and millet	sunflowers	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witch grass	proso millet	wild oats	vol. corn	vol. wheat	vol. barley	buckwheat, wild	cocklebur	fleabane, Canada	lady's-thumb	lamb's-quarters	wild mustard	nightshades, annual	pigweed	ragweed, common	ragweed, giant	velvetleaf	field bindweed	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada			
LONTREL	✓					0	0	0	0	0	0	0	0	0	0	0	0	8	-	-	3	5	0	-	5	8	-	-	3	-	-	0	0	8	8			
MCPA		✓				0	0	0	0	0	0	0	0	0	0	0	0	2	7	-	2	9	9	-	9	9	-	8	7	7	0	0	0	7	7			
MUSTER	✓					0	0	0	0	0	0	0	0	0	-	0	0	2	0	-	0	2	9	2	8	2	1	0	0	0	0	0	0	0	0			
PARDNER, BROTEX , KORIL			✓			0	0	0	0	0	0	0	0	0	0	0	0	9	8	-	9	9	8	9	8	9	-	9	7	0	0	0	0	7	7			
Postemergence Grass and Broadleaf Herbicides – For Use With Herbicide Tolerant Canola Varieties																																						
glyphosate ³	✓					9	9	9	9	9	9	9	9	9	9	9	9	8	9	9	8	9	9	9	9	9	8	9	7/8	5	8	6	9	8	9			
LIBERTY ¹	✓					9	9	9	9	9	8	9	9	8	-	-	-	8	9	7	8	9	9	9	9	9	-	8	6	6	-	6	6	8	7			
PURSUIT ²	✓					8	7	7	9	9	9	8	7	8	-	-	-	8	7	2	9	9	9	9	9	8	6	9	2	2	2	4	5	2	2			
Postemergence Tank-Mixes																																						
POAST ULTRA + BUCTRIL M or BADGE or LOGIC M or MEXTROL	✓					9	8	9	9	9	9	9	9	8	8	7	7	9	8	-	9	9	9	9	8	9	-	9	7	7	-	-	6	7	7			
POAST ULTRA + LONTREL	✓					9	8	9	9	9	9	9	9	8	8	7	7	8	-	-	3	5	0	-	5	8	-	-	3	-	-	0	6	8	8			
POAST ULTRA + MCPA*	✓					9	8	9	9	9	9	9	9	8	8	7	7	2	7	-	2	9	9	-	9	9	-	8	7	8	0	0	6	7	7			
POAST ULTRA + MUSTER	✓					9	8	9	9	9	9	9	9	8	8	7	7	2	0	-	0	2	9	2	8	2	-	0	0	0	0	0	6	0	0			
SELECT + BUCTRIL M or BADGE or LOGIC M or MEXTROL	✓					9	8	9	9	9	9	9	9	-	-	-	-	9	8	-	9	9	9	9	8	9	-	9	7	7	-	-	7	7	7			
VENTURE + LONTREL	✓					9	8	9	8	8	8	9	8	9	9	9	9	8	-	-	3	5	0	-	5	8	-	-	3	-	-	0	9	8	8			
VENTURE + MUSTER	✓					9	8	9	8	8	8	9	8	9	9	9	9	2	0	-	0	2	9	2	8	2	-	0	0	0	0	0	9	0	0			

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. See label for specific uses and rates.

- Insufficient information available to make a rating.

✓ Can be used on this crop.

BOLD numbers indicates the weed is listed on the product label for control or suppression.

¹ Use only on crops planted with certified canola seed designated as "Liberty Link" Canola.

² Use only on crops planted with certified canola seed designated as "Pursuit Tolerant" Canola.

³ Use only on crops planted with certified canola seed designated as "Roundup Ready" Canola. See Table 4-3. *Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops*, page 60 for a complete list of registered products.

Herbicide Treatments Include:

- **Preplant (PP)** – Also see *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.
- **Preplant Incorporated (PPI)** – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread

perennial weeds to previously uninfested areas. Ensure machines are clean and/or treat fields with perennial weeds last.

- **Preemergence (PRE)** – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improves herbicide activity in the absence of rainfall.

- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

CANOLA – WINTER AND SPRING PLANTED

Canola – Soil Applied Grass Herbicides

TREFLAN EC (480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac	• Apply PPI. • Strongly absorbed to soil particles, negligible leaching.
or RIVAL (500 g/L)	1.2–2.3 L/ha	0.4–0.76 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
trifluralin	0.6–1.147 kg/ha		

Canola – Postemergence Grass Herbicides

ASSURE II (96 g/L) plus SURE-MIX	0.375–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac 5 L/1,000 L	• Apply to annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2–6 leaf stage of growth. • Canola is tolerant at all growth stages. • Do NOT apply to canola within 64 days of harvest.
quizalofop-p-ethyl plus oil concentrate	0.036–0.072 kg/ha 0.5% v/v		
EXCEL SUPER (80.5 g/L)	0.67 L/ha	0.27 L/ac	• Apply to annual grasses in the 1–6 leaf stage of growth. • Canola is tolerant at all growth stages. • This treatment will not control volunteer winter wheat.
fenoxaprop-p-ethyl	0.054 kg/ha		
POAST ULTRA (450 g/L) plus MERGE	0.32–0.47 L/ha 1–2 L/ha	0.13–0.19 L/ac 0.4–0.8 L/ac	• Apply at 1–6 leaf stages of annual grasses. • Canola is tolerant at all growth stages.
sethoxydim plus surfactant/solvent	0.15–0.2 kg/ha 1–2 L/ha		
POAST ULTRA (450 g/L) plus MERGE	1.1 L/ha 1–2 L/ha	0.45 L/ac 0.4–0.8 L/ac	• Thorough preplant tillage will provide more uniform quackgrass emergence. • Apply to quackgrass in the 1–3 leaf stage of growth.
sethoxydim plus surfactant/solvent	0.5 kg/ha 1–2 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SELECT (240 g/L) plus AMIGO	0.13–0.19 L/ha 5 L/1,000 L	0.05–0.08 L/ac 5 L/1,000 L	• Canola is tolerant at all growth stages. • Apply to annual grasses and volunteer cereals in the 2–6 leaf stage of growth. • Suppression of quackgrass when applied at the higher dose.
clethodim plus surfactant	0.03–0.045 kg/ha 0.5 % v/v		
VENTURE L (125 g/L)	0.8 L/ha	0.32 L/ac	• For the control of volunteer cereals. • Apply at the 2–5 leaf stage of volunteer cereals.
fluzifop-p-butyl	0.100 kg/ha		
VENTURE L (125 g/L)	1.0–1.4 L/ha	0.4–0.57 L/ac	• Apply to annual grasses in the 2–5 leaf stage of growth and 3–5 leaf stage of quackgrass. • Use the 1.4 L/ha (0.57 L/ac) rate for a mixed stand of annual grasses and quackgrass. • Do NOT apply VENTURE to canola later than the 5 leaf stage of crop growth.
fluzifop-p-butyl	0.125–0.175 kg/ha		
Canola – Postemergence Broadleaf Herbicides			
LONTREL 360 (360 g/L)	0.42–0.56 L/ha	0.17–0.22 L/ac	• Recommended for use only on the following cultivars: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401. • Apply one postemergence application per season at the 2–6 leaf stage of canola. • Apply to Canada thistle at the rosette to pre-bud stage.
clopyralid	0.15–0.2 kg/ha		
MUSTER (75 DF) plus AGRAL 90	15 g/ha 2 L/1,000 L	6 g/ac 2 L/1,000 L	• Do NOT apply MUSTER to Polish varieties of canola as crop injury may result. • Apply when the wild mustard in the cotyledon to 6 leaf stages, before the crop begins to bolt. • Do NOT apply to winter planted canola. • Do NOT plant to any crop except winter wheat in the year of treatment. • Do NOT feed or graze treated crop within 60 days of application.
ethametsulfuron-methyl plus surfactant	11 g/ha 0.2% v/v		
Canola – Postemergence Grass and Broadleaf Herbicides			
POAST ULTRA (450 g/L)	0.32–0.47 L/ha	0.13–0.19 L/ac	• Apply when canola is between the 2–6 leaf stages.
plus LONTREL 360 (360 g/L)	0.42–0.56 L/ha	0.17–0.22 L/ac	• LONTREL is used on the following cultivars only: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401.
plus MERGE	0.75–1 L/ha	0.3–0.4 L/ac	• Add ½ amount of water to tank, add the required amount of POAST ULTRA, and then add the required amount of LONTREL. Add MERGE last along with remaining amount of water to fill the tank.
sethoxydim plus clopyralid plus surfactant/solvent	0.15–0.2 kg/ha 0.15–0.2 kg/ha 0.75–1 L/ha		
POAST ULTRA (450 g/L)	0.32–0.47 L/ha	0.13–0.19 L/ac	• Do NOT apply to winter planted canola.
plus MUSTER (75 DF)	15 g/ha	6 g/ac	• Apply when canola is between the 2 leaf stage and bolting.
plus MERGE	0.75–1 L/ha	0.3–0.4 L/ac	• Add MUSTER to the tank first and agitate. Once MUSTER is in suspension add the required amount of POAST ULTRA, followed by the correct amount of MERGE.
sethoxydim plus ethametsulfuron-methyl plus surfactant/solvent	0.15–0.2 kg/ha 11 g/ha 0.75–1 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
POAST ULTRA (450 g/L) plus MUSTER (75 DF) plus LONTREL 360 (360 g/L) plus MERGE	0.32–0.47 L/ha 15 g/ha 0.42 L/ha 0.75–1 L/ha	0.13–0.19 L/ac 6 g/ac 0.17 L/ac 0.3–0.4 L/ac	• Do NOT apply to winter planted canola. • Apply when canola is between the 2 leaf stage and bolting. • Add MUSTER to the tank first and agitate. Once MUSTER is in suspension add the required amount of POAST ULTRA, followed by the correct amount of MERGE.
sethoxydim plus ethametsulfuron-methyl plus clopyralid plus surfactant/solvent	0.15–0.2 kg/ha 11 g/ha 0.15 kg/ha 0.75–1 L/ha		
VENTURE L (125 g/L) plus LONTREL 360 (360 g/L)	1.0–1.4 L/ha 0.42–0.56 L/ha	0.4–0.57 L/ac 0.17–0.22 L/ac	• Do NOT apply VENTURE to canola later than the 5 leaf stage of crop growth. • LONTREL is recommended for use ONLY on the following cultivars: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401. • Add VENTURE to the tank first and agitate before adding LONTREL L.
fluzafop-p-butyl plus clopyralid	0.125–0.175 kg/ha 0.15–0.2 kg/ha		
VENTURE L (125 g/L) plus MUSTER (75 DF)	1.0–1.4 L/ha 15 g/ha	0.4–0.57 L/ac 6 g/ac	• Do NOT apply to winter planted canola. • Do NOT apply VENTURE to canola later than the 5 leaf stage of crop growth. • Do NOT apply MUSTER tank-mix to Polish varieties of canola as crop injury may result. • Add MUSTER to the tank-mix first and agitate before adding VENTURE.
fluzafop-p-butyl plus ethametsulfuron-methyl	0.125–0.175 kg/ha 11 g/ha		
Canola – Postemergence Grass and Broadleaf Herbicides (for use with herbicide tolerant varieties only)			
glyphosate (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	0.825–1.875 L/ha 0.67–1.5 L/ha 0.6–1.4 L/ha 0.6–1.35 L/ha 0.55–1.27 L/ha	0.33–0.75 L/ac 0.27–0.6 L/ac 0.24–0.56 L/ac 0.24–0.54 L/ac 0.22–0.51 L/ac	• For use only with pedigree (certified) canola seed designated as "Roundup Ready" Canola. • Apply up to the 6 leaf stage of the canola. A second application may be made for later flushes emerging after the initial application and for improved results on perennial weeds. • The higher rate should be used when weeds are larger, when weed pressure is high and for perennial weeds.
glyphosate*	0.297–0.45 kg/ha		
LIBERTY 200 SN (200 g/L)	2.5 L/ha	1 L/ac	• LIBERTY 200SN can be applied from the cotyledon to the early bolting stage of canola. • For use only with canola seed designated as "Liberty Link" Canola.
glufosinate ammonium	0.50 kg/ha		• Ammonium sulphate can be applied at 6 L/ha (2.4 L/ac) (liquid) or 3.3 kg/ha (1.3 kg/ac) (dry) for improved control of specific weeds. • Do NOT add oil or any other surfactants.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
PURSUIT (240 g/L) plus non-ionic surfactant plus liquid fertilizer 10-34-0, 28-0-0 or 32-0-0	0.312 L/ha 2.5 L/1,000 L 2 L/ha	0.125 L/ac 2.5 L/1,000 L 0.8 L/ac	• For use on imazethapyr tolerant canola only. • Apply early postemergence when the crop has at least one fully expanded leaf and before the weeds reach the 2 true leaf stage. • PURSUIT will provide residual weed control from soil activity. • Some rotational cropping restrictions apply, see Table 4-4. <i>Herbicide Crop Rotation and Soil pH Restrictions</i>, page 61.
imazethapyr plus non ionic surfactant plus liquid fertilizer	0.075 kg/ha 0.25% v/v 2 L/ha		
glyphosate (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)* plus LONTREL 360 (360 g/L)	1.25 L/ha 1 L/ha 0.94 L/ha 0.9 L/ha 0.83 L/ha 0.28 L/ha	0.5 L/ac 0.4 L/ac 0.38 L/ac 0.36 L/ac 0.33 L/ac 0.11 L/ac	• For use only with certified canola seed designated as "Roundup Ready" Canola. • Provides season long top growth control of Canada thistle and control of wild buckwheat. • Apply when canola is in the 2–6 leaf stage. • Apply in 100 L/ha (40 L/ac) of water. • For more information on weed controlled and rates, refer to the LONTREL and appropriate glyphosate product labels.
glyphosate plus clopyralid	0.45 kg/ha 0.10 kg/ha		
Canola – Preharvest			
glyphosate* (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.5 L/ha 2 L/ha 1.875 L/ha 1.8 L/ha 1.67 L/ha	1 L/ac 0.8 L/ac 0.75 L/ac 0.72 L/ac 0.67 L/ac	• Apply in 50–100 L/ha (20–40 L/ac) water when the crop is less than 30% grain moisture, when pods are green to yellow and seeds are yellow to brown and 7–14 days prior to harvest and use ground application only. • Do NOT apply to seed crops.
glyphosate*	0.9 kg/ha		
Canola – Harvest-Aid			
REGLONE DESICCANT (240 g/L) plus AGRAL 90	1.25–1.7 L/ha 1 L/1,000 L	0.5–0.68 L/ac 1 L/1,000 L	• Apply when crop is 60%–75% seed turn (green or brown) stage. • Harvest no later than 14 days after herbicide application to avoid pod shatter. • Use higher rate for heavy canopy. • Use minimum of 225 L/ha spray volume. • DRIFT will injure adjacent crops or plants.
diquat plus surfactant	0.3–0.408 kg/ha 0.1% v/v		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

FLAX

Preplant (PP) – See *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.

Flax – Postemergence Grass Herbicides

ASSURE II (96 g/L) plus SURE-MIX	0.375–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac 5 L/1,000 L	• Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2–6 leaf stage of growth. • Use the 0.375 L/ha (0.15 L/ac) rate for control of volunteer corn, volunteer cereals and green foxtail. • The 0.5 L/ha (0.2 L/ac) rate provides suppression of quackgrass and will also control barnyard grass. • Use the 0.75 L/ha (0.3 L/ac) rate for control of quackgrass. • Do NOT apply to flax within 82 days of harvest.
quizalofop-p-ethyl plus oil concentrate	0.036–0.072 kg/ha 0.5% v/v		
POAST ULTRA (450 g/L) plus ASSIST or MERGE	0.32–0.47 L/ha 2 L/ha 1 L/ha	0.13–0.19 L/ac 0.8 L/ac 0.4 L/ac	
sethoxydim plus oil concentrate or surfactant/solvent	0.15–0.2 kg/ha 2 L/ha 1 L/ha		• Do NOT use on low-linolenic varieties. • Treat the 1–6 leaf stage of annual grass. • For annual grasses and volunteer cereals. • Use the higher rate when volunteer cereals are present. • Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. • Flax is tolerant at any stage of growth. • Apply using 110–200 L/ha of water (44–80 L/ac).
POAST ULTRA (450 g/L) plus MERGE	1.1 L/ha 1–2 L/ha	0.45 L/ac 0.4–0.8 L/ac	
sethoxydim plus surfactant/solvent	0.5 kg/ha 1–2 L/ha		
SELECT (240 g/L) plus AMIGO	0.13–0.38 L/ha 5–10 L/1,000 L	0.05–0.15 L/ac 5–10 L/1,000 L	• Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stages. • Apply to quackgrass in the 2–5 leaf stages. Use the higher rate for control of quackgrass. • Flax is tolerant at any growth stage.
clethodim plus surfactant	0.03–0.09 kg/ha 0.5–1% v/v		
VENTURE L (125 g/L)	0.6 L/ha	0.24 L/ac	
fluzifop-p-butyl	0.075 kg/ha		• Apply at 2–4 leaf stage of annual grasses.
VENTURE L (125 g/L)	2 L/ha	0.8 L/ac	
fluzifop-p-butyl	0.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Flax – Postemergence Broadleaf Herbicides			
BASAGRAN (480 g/L) plus ASSIST	1.75–2.25 L/ha 2 L/ha	0.7–0.9 L/ac 0.8 L/ac	• Apply when flax is 5 cm or higher and weeds are small and actively growing. • Top growth of nutsedge and Canada thistle is controlled and field bindweed may be suppressed. Two applications of 1.75 L/ha (0.7 L/ac) (0.84 kg active/ha), 10 days apart may be required. • A new flush of weeds may emerge after the first flush has been controlled. • Cool weather or drought may reduce control. • Reduce oil concentrate to 1 L/ha (0.4 L/ac) under abnormally hot and humid weather conditions or temporary crop injury may occur.
bentazon plus oil concentrate	0.84–1.08 kg/ha 2 L/ha		
BUCTRIL M ((1:1) 560 g/L) or BADGE, LOGIC M, MEXTROL ((1:1) 450 g/L)	1 L/ha 1.25 L/ha	0.4 L/ac 0.5 L/ac	
bromoxynil/MCPA	0.56 kg/ha		• Apply when the flax is 5–10 cm high before weeds have developed beyond the 4 leaf stage. • Do NOT use if the daytime temperature is over 29°C.
MCPA AMINE (500 g/L)*	1 L/ha	0.4 L/ac	
MCPA*	0.5 kg/ha		
Flax – Postemergence Grass and Broadleaf Herbicides			
POAST ULTRA (450 g/L) plus BUCTRIL M ((1:1) 560 g/L) or BADGE, LOGIC M, MEXTROL ((1:1) 450 g/L) plus MERGE	0.32–0.47 L/ha 1 L/ha 1.25 L/ha 1 L/ha	0.13–0.19 L/ac 0.4 L/ac 0.5 L/ac 0.4 L/ac	• Apply when flax is 5–10 cm high before weeds have developed beyond the 4 leaf stage. • Do NOT use if the daytime temperature is over 29°C. • Apply using 100–200 L/ha of water (40–80 L/ac).
sethoxydim plus bromoxynil/ MCPA plus surfactant/solvent	0.15–0.2 kg/ha 0.56 kg/ha 1 L/ha		
POAST ULTRA (450 g/L) plus MCPA AMINE (500 g/L)* plus MERGE	0.32–0.47 L/ha 0.84–1.1 L/ha 1 L/ha	0.13–0.19 L/ac 0.34–0.44 L/ac 0.4 L/ac	
sethoxydim plus MCPA* plus surfactant/solvent	0.15–0.2 kg/ha 0.42–0.55 kg/ha 1 L/ha		• Flax may be treated when 5 cm tall to bud stage. • Best weed control is obtained if the application is made when the weeds are small (approximately 5 cm tall). • Apply using 100–200 L/ha of water (40–80 L/ac).

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SELECT (240 g/L) plus BUCTRIL M ((1:1) 560 g/L) or BADGE, LOGIC M, MEXTROL ((1:1) 450 g/L) plus AMIGO	0.19 L/ha 1 L/ha 1.25 L/ha 5 L/1,000 L	0.076 L/ac 0.4 L/ac 0.5 L/ac 5 L/1,000 L	• Apply when flax is 5–10 cm high and weeds are in the seedling stage for best results. • Do NOT use if daytime temperature is over 25°C.
clethodim plus bromoxynil/ MCPA plus surfactant	0.045 kg/ha 0.56 kg/ha 0.5% v/v		
Flax – Preharvest			
glyphosate (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.5 L/ha 2 L/ac 1.875 L/ha 1.8 L/ha 1.67 L/ha	1 L/ac 0.8 L/ac 0.75 L/ac 0.72 L/ac 0.67 L/ac	• Apply in 50–100 L/ha (20–40 L/ac) water when the crop is less than 30% grain moisture, when the majority of bolls are brown (75–80%) and 7–14 days prior to harvest. • Do NOT apply to seed crops.
glyphosate*	0.9 kg/ha		
REGLONE DESICCANT (240 g/L) plus AGRAL 90	1.25–1.7 L/ha 1 L/1,000 L	0.5–0.68 L/ac 1 L/1,000 L	• Apply when the crop is at 75% boll turn stage. • Do NOT apply to immature crop. • This application reduces dry down time and eliminates the need for swathing.
diquat plus non-ionic surfactant	0.3–0.408 kg/ha 0.1% v/v		

INDUSTRIAL HEMP GROWN FOR FIBRE PRODUCTION

Site Preparation Before Planting – Preplant Weed Control, Preplant Site Preparation Prior To Any Crop, page 81.

Industrial Hemp – Postemergence Grass Herbicides

ASSURE II (96 g/L) plus SURE-MIX	0.38–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac 5 L/1,000 L	• Make one application per year. Apply to emerged annual grasses and volunteer cereals when the crop is at the 2–6 crop leaf stage (6–25 cm in height). • Use the 0.38 L/ha (0.15 L/ac) rate of ASSURE II for control of volunteer corn, volunteer cereals and green foxtail. • The 0.5 L/ha (0.2 L/ac) rate of ASSURE II will suppress quackgrass and also control barnyard grass. • Use the 0.75 L/ha (0.3 L/ac) rate of ASSURE II for control of quackgrass. • Use a minimum of 100 litres of water/ha with a spray pressure of 210–275 kPa.
quizalofop-p-ethyl plus oil concentrate	0.036–0.07 kg/ha 0.5% v/v		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

MUSTARD

Preplant (PP) – See *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.

Mustard – Soil Applied Grass and Broadleaf Herbicides

TREFLAN EC (480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac
or RIVAL (500 g/L)	1.2–2.3 L/ha	0.4–0.76 L/ac
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac

trifluralin 0.6–1.147 kg/ha

- Apply PPI.
- Strongly absorbed to soil particles, negligible leaching.
- **Do NOT** use on sandy soils.
- Can be applied immediately prior to, or up to 3 weeks before planting.

Mustard – Postemergence Grass Herbicides

POAST ULTRA (450 g/L)	0.32–0.47 L/ha	0.13–0.19 L/ac
plus ASSIST	2 L/ha	0.8 L/ac
or MERGE	1 L/ha	0.4 L/ac

sethoxydim 0.15–0.2 kg/ha
plus oil concentrate 2 L/ha
or surfactant/solvent 1 L/ha

- Treat the 1–6 leaf stage of annual grass.
- For annual grasses and volunteer cereals.
- Use the higher rate when volunteer cereals are present.
- Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA.
- Flax is tolerant at any stage of growth.
- Apply using 110–200 L/ha of water (44–80 L/ac).

POAST ULTRA (450 g/L)	1.1 L/ha	0.45 L/ac
plus MERGE	1–2 L/ha	0.4–0.8 L/ac

sethoxydim 0.5 kg/ha
plus surfactant/solvent

- For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence.
- Apply using 100–200 L/ha of water (40–80 L/ac).

Mustard – Preharvest

REGLONE DESICCANT (240 g/L)	1.25–1.7 L/ha	0.5–0.68 L/ac
plus AGRAL 90	1 L/1,000 L	1 L/1,000 L

diquat 0.3–0.408 kg/ha
plus surfactant 0.1% v/v

- Apply when crop is 60%–75% seed turn (green or brown) stage.
- Harvest no later than 14 days after herbicide application to avoid pod shatter.
- Use higher rate for heavy canopy.
- Use minimum of 225 L/ha spray volume.
- DRIFT will injure adjacent crops or plants.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

PEANUTS

Preplant (PP) – See *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.

Peanuts – Preemergence Grass Herbicides

FRONTIER MAX (720 g/L) 756–860 mL/ha 302–344 mL/ac

dimethenamid 544–619 g/ha

- Apply PPI.
- Peanuts should be seeded at least 4 cm deep or crop injury may occur.
- **Do NOT** apply within 80 days of harvest.

Peanuts – Postemergence Broadleaf Herbicides

BASAGRAN (480 g/L) 2.25 L/ha 0.9 L/ac
plus ASSIST 2 L/ha 0.8 L/ac

bentazon 1.08 kg/ha
plus oil concentrate 2 L/ha

- Apply when peanuts are in the unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing.
- Many annual broadleaf weeds including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf) are controlled.
- Top growth of Canada thistle and yellow nutsedge is controlled and field bindweed may be suppressed but two applications of BASAGRAN at 1.75 L/ha (0.7 L/ac) 10 days apart may be required.
- A new flush of weeds may emerge after the first flush has been controlled.
- Temporary crop injury may occur under abnormally cool or hot, humid conditions. Reduce rate of oil concentrate to 1 L/ha (0.4 L/ac) when those conditions occur. Cool weather or drought may delay or reduce control.

SORGHUM AND MILLET (GRAIN)

Preplant (PP) – See *Preplant Weed Control, Preplant-Site Preparation Prior To Any Crop*, page 81, for details of products, rates and remarks.

Sorghum and Millet (Grain) – Postemergence Broadleaf Herbicides

BASAGRAN FORTÉ(480 g/L) 1.75–2.25 L/ha 0.7–0.9 L/ac

bentazon 0.84–1.08 kg/ha

- Apply when the crop is at the 3–6 leaf stage.
- Annual weeds should be targeted at the 4–6 leaf stage.
- A new flush of weeds may emerge after the first flush has been controlled.
- Cool weather or drought may reduce control.
- Reduce oil concentrate to 1 L/ha (0.4 L/ac) under abnormally hot and humid weather conditions or temporary crop injury may occur.
- **Do NOT** apply within 100 days of harvest.

PARDNER (280 g/L) 1 L/ha 0.4 L/ac
or BROTEX (240 g/L) 1.2 L/ha 0.48 L/ac

bromoxynil 0.28 kg/ha

- Apply when the crop is at or beyond the 4 leaf stage and less than 20 cm in height.
- One application per year.
- **Do NOT** apply within 100 days of harvest.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

SUNFLOWERS

Cultural control of weeds in sunflowers can be used successfully, but only if weeds are also controlled in other crops in the rotation. There are several tillage options in the sunflower crop.

Preplant tillage can control one or two flushes of early germinating weeds. Plant sunflowers immediately after the last tillage operation.

A rotary hoe set to cultivate shallow can be effective in removing annual weeds that are just emerging. It is not very useful for controlling well-rooted seedlings.

Spring tooth harrows can be used to control small weeds when sunflowers are in the 4–6 leaf stages. There will be some damage to sunflowers and larger weeds will not be well controlled.

One or two cultivations with a row crop cultivator are the most common form of cultural control. Sunflowers have to be big enough to withstand burial. Lateral roots on sunflowers are shallow, so avoid cultivating too deep or too close to plants.

Sunflowers – Soil Applied Grass Herbicides

EPTAM (800 g/L)	4.25 L/ha	1.7 L/ac
EPTC	3.4 kg/ha	
TREFLAN EC (480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac
or RIVAL (500 g/L)	1.2–2.3 L/ha	0.48–0.92 L/ac
trifluralin	0.6–0.155 kg/ha	

- Apply PPI.
- **Do NOT** use on light sandy soils with less than 3% organic matter.

Sunflowers – Postemergence Grass Herbicides

POAST ULTRA (450 g/L)	0.32–0.47 L/ha	0.13–0.19 L/ac
plus ASSIST	2 L/ha	0.8 L/ac
or MERGE	1 L/ha	0.4 L/ac
sethoxydim	0.15–0.2 kg/ha	
plus oil concentrate	2 L/ha	
or surfactant/solvent	1 L/ha	
POAST ULTRA (450 g/L)	1.1 L/ha	0.45 L/ac
plus MERGE	1–2 L/ha	0.4–0.8 L/ac
sethoxydim	0.5 kg/ha	
plus surfactant/solvent		
SELECT (240 g/L)	0.13–0.38 L/ha	0.05–0.15 L/ac
plus AMIGO	5–10 L/1,000 L	5–10 L/1,000 L
clethodim	0.03–0.09 kg/ha	
plus surfactant	0.5% v/v	
VENTURE L (125 g/L)	0.6 kg/ha	0.24 L/ac
fluzifop-p-butyl	0.075 kg/ha	

- Apply PPI.
- Treat the 1–6 leaf stage of annual grass.
- For annual grasses and volunteer cereals.
- Use the higher rate when volunteer cereals are present.
- Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA.
- Flax is tolerant at any stage of growth.
- Apply using 110–200 L/ha of water (44–80 L/ac).
- For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence.
- Apply using 100–200 L/ha of water (40–80 L/ac).
- Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stages.
- Apply to quackgrass in the 2–5 leaf stages. Use the higher rate for control of quackgrass.
- Allow 72 days between application and harvest.
- This rate is for control of volunteer corn only.
- Apply at 2–5 leaf stage of the volunteer corn.

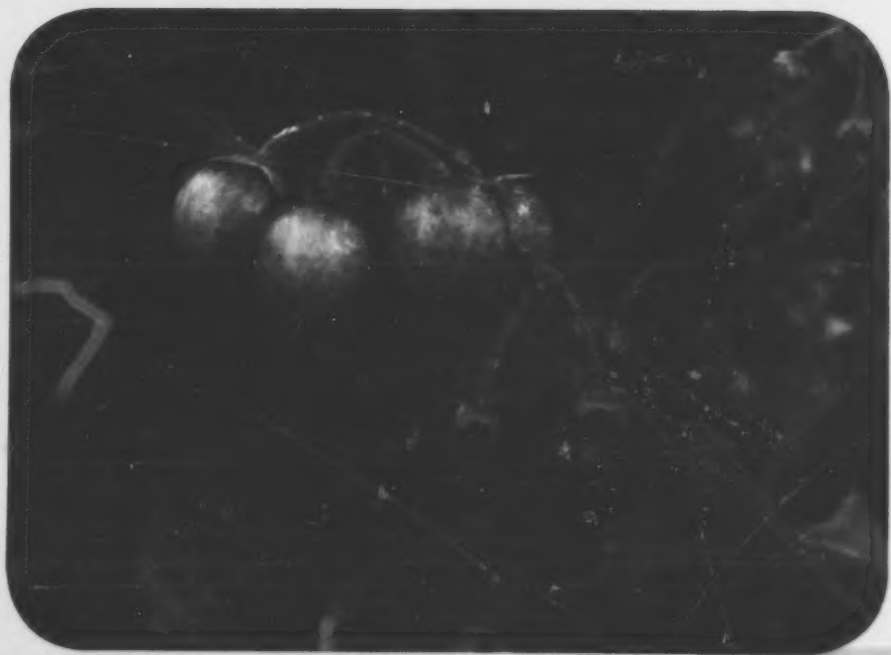
TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
VENTURE L (125 g/L)	1.0–1.4 L/ha	0.4–0.57 L/ac	• Apply at 2–4 leaf stage of annual grasses and at 3–5 leaf stage quackgrass.
<i>fluazifop-p-butyl</i>	0.125–0.18 kg/ha		
Sunflowers – Harvest-Aid			
REGLONE DESICCANT (240 g/L) plus AGRAL 90	1.25 L/ha	0.5 L/ac	• REGLONE may be used to reduce the period of time from maturity to harvest, to speed up harvesting, and decrease seed moisture at harvest.
	1 L/1,000 L	1 L/1,000 L	• Spray when seeds reach maturity (20%–50% seed moisture).
<i>diquat</i>			• Combine 15–20 days after spraying.
plus surfactant	0.3 kg/ha		• Beware of drift to adjacent crops or plants.
	0.1% v/v		• See Chapter 4. <i>Herbicides Used in Ontario</i> , page 23, for comments on aerial application.

TOBACCO

Tobacco – Post Transplant Herbicides

Apply in 150–300 L/ha (60–120 L/ac) water.

DEVINOL DF (50 DF)	2.25–4.5 kg/ha	0.9–1.8 kg/ac	• Apply immediately following transplanting in a 25–30 cm band over the transplants.
			• Use lower rates on lighter soils.
<i>napropamide</i>	1.125–2.25 kg/ha		• For best results, lightly incorporate or apply irrigation if rainfall does not occur within two days of application.
			• After harvest, soil should be worked at right angles to the rows to prevent injury to succeeding crops. Small grains may be seeded in the fall to prevent soil erosion. These grains may be stunted but not otherwise affected.
VENTURE L (125 g/L)	0.6–1 L/ha	0.24–0.4 L/ac	• May be applied up to 45 days to harvest.
<i>fluazifop-p-butyl</i>	0.075–0.125 kg/ha		



13. VEGETABLE CROPS

In April of 2009, the Ministry of Environment amended the *Pesticides Act* with the *Cosmetic Pesticides Ban Act, 2008* and Ontario Regulation 63/09. Pesticides are now classified for sale and use under 11 different classes. It should be noted that agriculture (e.g. nursery production) is exempted. For more information on the legislation see the Ministry of the Environment's website at www.ontario.ca/pesticideban.

More than 50 vegetable crops are grown commercially in Ontario. Some are seeded, some transplanted, some are annuals, and other crops are perennial, presenting a very diverse group of situations to manage weeds. Weed management involves all aspects of weed control in vegetable crops including scouting, herbicides, cultivation, hoeing, mulches, etc.

Perennial weeds are often a more severe problem in perennial horticultural crops, such as asparagus and need to be controlled prior to planting.

Recommendations for snap beans and sweet corn are listed in the field crop section (Beans, page 87 and Corn, page 105) because they are similar to those for field corn and field beans. Differences are noted where necessary.

Treatments listed for horticultural crops in this publication are based on extensive research trials. Do not use herbicides in cold frames or greenhouses unless specifically recommended.

Horticultural crops are often high value crops. Weed competition is costly. Improper application of herbicides can also be costly. Sprayers used for hormone type herbicides (2,4-D, etc.) should not be used to

apply insecticides, fungicides or other herbicides on susceptible horticultural crops.

Herbicide Application Timings

Preplant (PP) Treatments

Preplant treatments are applied before the crop is sown or planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be thoroughly incorporated into the soil by cultivation soon after application. Check the label. Also see *Preplant Weed Control, Preplant Site Preparation Prior To Any Crop* on page 81 for details of products, rates and remarks.

Preplant (PP) Weed and Cover Crop Control

Control cover crops and emerged weeds before seeding or transplanting vegetable crops. Refer to Table 6-1. *Non-Selective Herbicides Available for Preplant Site Preparation*, page 77. Alternatively, a grower may choose to kill the cover crop and/or emerged weeds just before planting the vegetable crop and either till the area or leave the seedbed untilled.

Preplant Incorporated (PPI)

Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improves herbicide activity in the absence of rainfall. These materials prevent emergence of many weed seedlings without reducing crop stand. Apply immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Postemergence (POST)

These chemicals are applied after the crop plants have sprouted or after the crop has been transplanted. Applied as directed, the weeds can be killed without injury to the crop. Leaf stage of the weeds is critical for good weed control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Inter-row Weeding

The herbicide is directed between the crop rows onto the emerged weeds. The herbicide is used as a rescue operation where other methods of weed control have failed. Use special low pressure (7–15 kPa) applicators such as dribble bars or vibra jets equipped with

shields to prevent wetting the crop. See *Stale Seedbed and Inter-Row Weeding*, page 82.

Stale Seedbed Technique

The stale seedbed technique is useful when the soil can be worked well before planting and weeds are allowed to emerge for several weeks. Apply one of the non-selective herbicides listed under the *Stale Seedbed and*

Inter-Row Weeding, page 82. Seeding or planting directly into the killed weeds with minimal soil disturbance will allow the crop to establish before the next flush of weed emergence. Follow up with either cultivation, hoeing or postemergent or directed herbicides to control later germinating weeds. Where registered, some herbicides can be applied after seeding but before crop emergence.

Wiper Applicators for Selective Weed Control
Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate (ROUNDUP). Check product labels for use of this application technique with other herbicides.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Crop tolerance ratings are E – Excellent, G – Good, F – Fair, P – Poor. Under unfavourable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 13-1. Vegetable Herbicide Weed Control Ratings

Trade Name	Grasses					Annual Broadleaves									Perennials					
	barnyard grass	crabgrass	fall panicum	foxtails	witch grass	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Soil Applied Grass Herbicides																				
DEVIRINOL	8	9	8	8	8	5	6	8	5	5	8	7	5	5	5	5	6	5	5	5
DUAL II MAGNUM	9	9	8	9	9	2	2	7	2	8	7/8	4	2	0	0	0	8	4	0	0
EPTAM	9	9	9	9	9	4	7	7	5	7	7	5	5	-	-	-	8	5	-	-
FRONTIER	9	9	8	9	9	2	2	7	2	8	8	4	2	0	0	0	8	0	0	0
Soil Applied Broadleaf Herbicides																				
ALANAP	5	7	5	7	-	5	9	9	6	5	8	5	-	-	5	-	5	5	5	5
GESAGARD	-	-	-	9	-	-	8	9	8	8	8	6	-	-	-	-	-	-	-	-
LOROX DF	7	5	5	7	7	8	9	9	9	8	9	8	6	2	2	2	2	2	2	2
PYRAMIN	5	5	5	5	5	8	8	8	8	8	8	8	6	5	5	-	5	5	5	5
SENCOR	7	6	7	8	8	7	9	9	9	3	9	8	8	2	2	2	2	2	2	2

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23.

- Insufficient information available to make a rating.

BOLD numbers indicates the weed is listed on the product label for control or suppression.

* Good control of these perennial weeds may require two applications, 7–10 days apart.

* Yellow foxtail will only be suppressed.

* Registered for control of hairy nightshade.

* Repeated applications may be necessary if regrowth occurs.

TABLE 13-1. Vegetable Herbicide Weed Control Ratings (cont'd)

Trade Name	Grasses					Annual Broadleaves								Perennials							
	barnyard grass	crabgrass	fall panicum	foxtails	witch grass	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	
Soil Applied Grass and Broadleaf Herbicides																					
COMMAND 360 ME	9	9	-	9	-	-	-	9	-	9	6	8/9	9	-	-	-	-	-	-	-	
DACTHAL W-75	6	8	8	8	8	0	0	8	0	0	7	0	0	-	-	-	-	0	0	0	
KARMEX or DIUREX 80WDG	9	8	7	8	-	8	8	9	8	7	8	9	-	-	5	-	5	5	5	5	
KERB	8	8	8	8	8	-	6	6	7	7	0	0	0	0	0	0	0	0	0	0	
NORTRON SC	7	6	7	7	7	8	8	8	8	7	8	8	7	5	5	5	6	5	5	5	
PURSUIT	8	7	7	9	9	8	9	9	9	9	9	8	9	-	-	-	7	5	-	-	
PRINCEP NINE-T	9	8	7	9	9	9	9	9	9	9	9	8	5	2	0	0	5	5	2	2	
PROWL	9	9	9	8	-	-	6	9	-	8	8	2	6	-	-	-	-	-	-	-	
PURSUIT	8	7	7	9	9	8	9	9	9	9	9	8	9	-	-	-	7	5	-	-	
SINBAR	8	7	8	8	8	-	7	8	8	7	7	7	7	-	5	6	6	6	-	6	
TREFLAN or RIVAL or BONANZA	9	9	9	9	9	5	7	8	2	2	8	4	2	2	2	2	2	2	2	2	
Postemergence Grass Herbicides																					
ASSURE II	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
EXCEL SUPER	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
KERB	8	8	6	8	-	-	0	0	0	-	6	0	0	0	0	0	0	8	0	0	
POAST ULTRA	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	
SELECT	9	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	
VENTURE L	8	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	
Postemergence Broadleaf Herbicides																					
2,4-D*	0	0	0	0	0	7	4	4	9	7	9	8	8	7	0	0	0	0	8	8	
AIM EC (Hooded Sprayer Appl'n.)	0	0	0	0	0	-	-	8	8	8	8	-	8	-	-	-	-	-	-	-	
BASAGRAN FORTÉ	0	0	0	0	0	7	9	8	7	7	8	8	9	6 ^a	2	2	8 ^a	0	6 ^a	7 ^a	
BETAMIX	5	5	5	7	5	6	6	8	7	6	8	8	5	5	-	-	5	5	5	5	

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23.

- Insufficient information available to make a rating.

BOLD numbers indicates the weed is listed on the product label for control or suppression.^a Good control of these perennial weeds may require two applications, 7-10 days part.^b Yellow foxtail will only be suppressed.^c Registered for control of hairy nightshade.^d Repeated applications may be necessary if regrowth occurs.

TABLE 13-1. Vegetable Herbicide Weed Control Ratings (cont'd)

Trade Name	Grasses					Annual Broadleaves								Perennials						
	barnyard grass	crabgrass	fall panicum	foxtails	witch grass	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
GOAL 2XL	5	5	5	5	5	9	8	8	9	9	9	8	7	5	5	5	5	5	5	5
herbicidal oil*	-	-	-	-	-	-	6	7	7	-	7	5	-	5	5	5	5	5	5	5
LONTREL	5	5	5	5	5	-	7	5	-	5	5	8	5	5	-	-	5	5	7	7
MCPA*	0	0	0	0	0	4	0	9	9	-	9	8	9	7	7	0	0	0	7	7
PARDNER	0	0	0	0	0	9	9	9	8	9	8	9	9	7	0	0	0	0	7	7
PINNACLE	0	0	0	0	0	-	8	9	8	3	9	5	8	2	2	2	2	2	2	2
PYRAMIN	5	5	-	5	-	8	8	8	8	8	8	8	-	-	5	-	5	5	5	5
TROPITOX PLUS <u>or</u> CLOVITOX PLUS <u>or</u> TOPSIDE	0	0	0	0	0	8	8	7	8	7	9	9	9	8	0	0	0	0	8	8
Postemergence Grass and Broadleaf Herbicides																				
LOROX DF	9	7	9	8	9	8	8	8	8	8	8	8	8	7	8	7	8	7	8	7
PRISM	9	8	9	8 ^b	9	-	7	7	9	4 ^c	9	3	6	-	-	-	-	7	-	-
SENCOR	8	7	9	8	9	7	9	8	9	-	8	8	7	-	-	-	-	7	-	-
Postemergence Tank-Mix Options																				
PRISM + PINNACLE	9	8	9	8 ^b	9	-	8	9	9	4 ^c	9	5	8	2	2	2	2	7	2	2
Preharvest and Post Harvest																				
IGNITE	9	9	9	9	9	-	9	9	9	-	9	9	9	8 ^d	7 ^d	6 ^d	0	8 ^d	-	-

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23.

- Insufficient information available to make a rating.

BOLD numbers indicates the weed is listed on the product label for control or suppression.

* Good control of these perennial weeds may require two applications, 7-10 days part.

^b Yellow foxtail will only be suppressed.^c Registered for control of hairy nightshade.^d Repeated applications may be necessary if regrowth occurs.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

ASPARAGUS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Preplant (Stale Seedbed Technique)

DUAL II MAGNUM (915 g/L)	1.55–1.75 L/ha	0.6–0.8 L/ac	• Apply before direct seeded or established spears emerge. • Application may result in injury to the asparagus crop, which may include potential stand loss, delayed maturity and even loss of yield. • Apply as a ground application only. • Use ONLY one application per year. • Do NOT apply to soil with less than 1% or more than 10% organic matter.
<i>s-metolachlor/benoxacor</i>	1.42–1.67 kg/ha		
GRAMOXONE (200 g/L) <i>alone or</i> <i>followed by</i> DEVIRINOL DF (50 DF)	3–5.5 L/ha 4.5–9 kg/ha	1.2–2.2 L/ac 1.8–3.6 kg/ac	• Apply before direct seeded or established spears emerge. • Apply in 300–1,100 L/ha (120–440 L/ac) water. Use the higher volume of water on dense weed growth. • Spray GRAMOXONE as a “chemical mower” to kill emerged seedling weeds before the first asparagus seedlings are beginning to emerge. • Apply DEVIRINOL as a separate application just before a second flush of weeds emerge.
<i>paraquat</i> <i>followed by napropamide</i>	0.6–1.1 kg/ha 2.25–4.5 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Apply before direct seeded or established spears emerge. • Apply in 110–330 L/ha (44–132 L/ac) water. • Spray uniformly on emerged weeds prior to emergence of the crop. • Weeds that have not emerged will not be controlled.
<i>glufosinate ammonium</i>	0.405–0.75 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1.25–2.5 L/ha 0.94–1.875 L/ha 0.9–1.8 L/ha 0.83–1.67 L/ha	0.5–1 L/ac 0.38–0.75 L/ac 0.36–0.72 L/ac 0.33–0.67 L/ac	• 2nd year and established plantings ONLY. • For control of fall-seeded rye and emerged weeds. • Apply in the spring before spears emerge, but not closer than 7 days to harvest. • Use ONLY one application per year.
<i>glyphosate*</i>	0.45–0.9 kg/ha		

Soil Applied Grass Herbicide

TREFLAN EC(480 g/L) or RIVAL EC (500 g/L) or BONANZA 400 (400 g/L)	2–4.2 L/ha 2–4 L/ha 2.5–5 L/ha	0.81–1.68 L/ac 0.8–1.6 L/ac 1–2 L/ac	• Established plantings ONLY. • PPI – Application should occur early enough in the spring to ensure that spears are not injured by the required incorporation (5–10 cm). • Apply after last cutting of spears (postharvest disking) and incorporate. • Established plantings of 3 years or more ONLY.
<i>trifluralin</i>	1–2 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Soil Applied Broadleaf Herbicides			
LOROX DF (50 DF)	3.3–4.3 kg/ha	1.32–1.72 kg/ac	• 2nd year and established plantings ONLY. • PRE – Disk before any shoots appear in the spring on established plantings. • A second application may be made after the postharvest disking. • Use lower rates for lighter soils. • Rates are given for overall sprays; reduce proportionately if only rows are sprayed.
linuron	1.6–2.15 kg/ha		
SENCOR 75 DF (75 WG)	1.46–3 kg/ha	0.58–1.2 kg/ac	• 2nd year and established plantings ONLY. • PRE – Disk before any shoots appear in the spring on established plantings. • A second application may be made after the postharvest disking. • Use lower rates for lighter soils. • Rates are given for overall sprays; reduce proportionately if only rows are sprayed.
metribuzin	1.1–2.25 kg/ha		
Soil Applied Grass and Broadleaf Herbicides			
CHATEAU WDG (51.1%)	0.28–0.42 kg/ha	0.11–0.16 kg/ac	• 1st year crown and established plantings ONLY. • Apply once per season to dormant asparagus established for at least one year. • Apply prior to weed emergence. • Apply lower rate on sandy (coarse textured) soils with less than 5% organic matter and the higher rate on clay (medium textured) with less than 5% organic matter. • Injury may result if spears emerge before the application has been activated with water. • Apply using ground application only.
flumioxazin	0.14–0.21 kg/ha		
DEVRIOL DF (50 DF)	4.5–9 kg/ha	1.8–3.6 kg/ac	• 1st year crown and established plantings ONLY. • PPI – Incorporation by irrigation or rainfall is essential. • Treat at planting time, or soon after planting before weed seedlings appear. • Use lower rate on sandy soils and the higher rate on clay soils.
napropamide	2.25–4.5 kg/ha		
KARMEX (80 DF) or DIUREX 80WDG	2.19–2.81 kg/ha 2.19–2.81 kg/ha	0.88–1.12 kg/ac 0.88–1.12 kg/ac	• 2nd year and established plantings ONLY. • PRE – Disk before any shoots appear in the spring on established plantings. • A second application may be made after the postharvest disking. • Use lower rates for lighter soils. • Rates are given for overall sprays; reduce proportionately if only rows are sprayed. • Do NOT apply if you are planning to take the crop out of production after harvest.
diuron	1.75–2.25 kg/ha		
PRINCEP NINE-T (90 WG) plus DEVRIOL DF (50 DF)	1.5–2.75 kg/ha 9–13.4 kg/ha	0.6–1.1 kg/ac 3.6–5.36 kg/ac	• 2nd year and established plantings ONLY. • PRE – Disk before any shoots appear in the spring on established plantings. • Use lower rates for lighter soils. • Make only one application per season. • Do NOT apply within 6 days of harvest.
simazine plus napropamide	1.35–2.48 kg/ha 4.5–6.7 kg/ha		
PRINCEP NINE-T (90 WG) or SIMADEx (500 g/L) SIMAZINE 480 (480 g/L)	2.5–3.75 kg/ha 4.5–6.7 L/ha 4.7–7 L/ha	1–1.5 kg/ac 1.8–2.68 L/ac 1.88–2.8 L/ac	• Established plantings ONLY. • PRE – Apply preemergence to crop, 7 days before first cutting. • A second application may be made after postharvest disking. • Use lower rates for lighter soils. • Rates are given for overall sprays; reduce proportionately if only rows are sprayed. • Do NOT apply if you are planning to take the crop out of production after harvest.
simazine	2.25–3.4 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SINBAR (80 WP)	0.375 kg/ha	0.15 kg/ac	• 2nd year and established plantings ONLY. • PRE – Apply before spears emerge, or immediately after clean cutting. • Apply ONLY once throughout the entire growing season. • Apply before weeds emerge, or to small, actively growing weeds (up to 5 cm). • Do NOT use on soils containing less than 1% organic matter, or where subsoil or roots are exposed. • Do NOT use on plants that are weak or diseased, or lacking in vigor (slow growing). • Do NOT harvest within 5 days of treatment. • Treated areas may be replanted to asparagus the following year after application. • Do NOT plant any other crop for 2 years.
terbacil	0.3 kg/ha		
Postemergence Grass Herbicides			
EXCEL SUPER (80.5 g/L)	0.67 L/ha	0.27 L/ac	• 2nd year and established plantings ONLY. • Apply to asparagus only after the spears have been harvested. • Do NOT treat spears prior to or during harvest. • Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. • Grasses emerging after application will not be controlled.
fenoxaprop-p-ethyl	0.054 kg/ha		
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply to direct seeded, 1st year crown, 2nd year and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 40 days.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply to direct seeded, 1st year crown and established plantings. • Apply POST to actively growing grasses before tillering. • One application per season only • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application.
fluazifop-p-butyl	0.075–0.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicide			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2.75 L/ha 2.29 L/ha 1.96 L/ha	1.1 L/ac 0.92 L/ac 0.78 L/ac	• 2nd year and established plantings ONLY. • After last cutting immediately after harvest or 3 weeks after the post cutting disking. Direct spray to avoid wetting the asparagus fern. • Apply in 50–200 L/ha (20–80 L/ac) water. • May be applied early in the season just after a cutting. • Spray immediately after a close harvest to avoid injury. • Emerging spears may be twisted and should be discarded. Later emerging spears will be normal.
2,4-D*	1.293 kg/ha		
Postemergence Grass and Broadleaf Herbicides			
SINBAR (80 WP)	0.38 kg/ha	0.15 kg/ac	• Apply before emergence of direct seeded asparagus ONLY. • PRE – Apply as a broadcast treatment within 2 days of seeding. • Plant asparagus seed to a depth of 4 cm in coarse (sandy) soils or 2.5 cm deep in fine (clay) soils into newly cultivated fields.
terbacil	0.3 kg/ha		
Post Harvest Herbicides			
DUAL II MAGNUM (915 g/L)	1.55–1.75 L/ha	0.6–0.8 L/ac	• Apply after last cutting of established asparagus. • Application may result in injury to the asparagus crop, which may include potential stand loss, delayed maturity and even loss of yield. • Apply as a ground application only. • Use ONLY one application per year. • Do NOT apply to soil with less than 1% or more than 10% organic matter.
s-metolachlor/benoxacor	1.42–1.67 kg/ha		
GRAMOXONE (200 g/L) alone or followed by DEVIRINOL DF (50 DF)	3–5.5 L/ha 4.5–9 kg/ha	1.2–2.2 L/ac 1.8–3.6 kg/ac	• Apply after last cutting of established asparagus. • Apply in 300–1,100 L/ha (120–440 L/ac) water. Use the higher volume of water on dense weed growth.
paraquat followed by napropamide	0.6–1.1 kg/ha 2.25–4.5 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Apply after last cutting of established asparagus. • Apply in 110–330 L/ha (44–132 L/ac) water.
glufosinate ammonium	0.405–0.75 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1.25–2.5 L/ha 0.94–1.875 L/ha 0.9–1.8 L/ha 0.83–1.67 L/ha	0.5–1 L/ac 0.38–0.75 L/ac 0.36–0.72 L/ac 0.33–0.67 L/ac	• 2nd year and established plantings ONLY. • Use ONLY one application per year.
glyphosate*	0.45–0.9 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

BEANS (LIMA AND SNAP) – SEE CHAPTER 7. BEANS, PAGE 87.

BEETS (SUGAR) – SEE SUGAR BEETS (PROCESSING), PAGE 240.

BEETS (RED)

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Broadleaf Herbicide

PYRAMIN FL (430 g/L)	8.25–10.25 L/ha	3.3–4.1 L/ac	• PRE – Apply in 150–300 L/ha (60–120 L/ac) water.
pyrazon	3.54–4.4 kg/ha		• Do NOT use on soils with less than 3% organic matter.
			• Rainfall or irrigation is required to activate the herbicide.

Soil Applied Grass and Broadleaf Herbicide

DUAL II MAGNUM (915 g/L)	1.25 L/ha	0.5 L/ac	• Pre-emergent to weeds.
s-metolachlor/benoxacor	1.14 kg/ha		• Apply as a ground application ONLY in 150 L water/ha minimum.
			• Use ONLY one application per year.
			• Irrigate after application to activate the herbicide if rainfall is not expected, but use only 0.5 inches of water to incorporate the herbicide. Excessive irrigation will increase the risk of crop injury. Mechanical incorporation of DUAL II MAGNUM will increase the risk of crop injury.
			• DO NOT use DUAL II MAGNUM if the planting operation creates a furrow or trough over the seed-row into which rain or irrigation water will collect and thus concentrate the herbicide over the row.

Postemergence Broadleaf Herbicides

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac	• Apply POST with a HOODED SPRAYER between the rows or between the plastic mulch.
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L	• Apply to actively growing weeds up to 10 cm tall.
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L	• Apply in a minimum of 100 L/ha (40 L/ac) water.
or MERGE	1 L/1,000 L	1 L/1,000 L	• Do NOT apply closer than 1 day to harvest.
			• Apply ONLY once per growing season
carfentrazone-ethyl	8.8–28.1 g/ha		
plus non-ionic surfactant	0.25% v/v		
or surfactant/solvent	0.1% v/v		
PYRAMIN FL (430 g/L)	8.25 L/ha	3.3 L/ac	• For best results, apply before third true beet leaf or broadleaf weeds.
plus CITOWETT PLUS	2.5 L/1,000 L water	2.5 L/1,000 L water	• Apply in 300–400 L/ha (120–160 L/ac) water.
pyrazon	3.54 kg/ha		• Do NOT use any other oils or surfactants, including ASSIST or MERGE or crop injury may result.
plus surfactant	0.25% v/v		

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23
and Chapter 5, *Notes on Adjuvants*, page 69).

CABBAGE, CAULIFLOWER, BROCCOLI, BRUSSELS SPROUTS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass Herbicides

DEVIRINOL DF (50 DF)	2.25–4.5 kg/ha	0.9–1.8 kg/ac	• PPI or PRE – Use ONLY on transplanted cabbage, cauliflower, and broccoli. • Use ONLY one application per year. • Use the lower rate on light soils (coarse textured to sandy and sandy loam). • Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5–5.0 cm. • Incorporate the same day as applied. • Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected. • Do NOT harvest within 60 days after harvest.
<i>napropamide</i>	1.12–2.25 kg/ha		
DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ac	• PRE to weeds – Apply after transplanting within 2 days, before weeds emerge. • Use the higher rate for heavier weed pressure. • Apply as a ground application ONLY in 300 L water/ha. • Use ONLY one application per year. • Do NOT incorporate and do not use on seeded cole crops. • Do NOT apply to soil with less than 1% or more than 10% organic matter. • Use ONLY on transplanted cabbage, cauliflower and broccoli.
<i>s-metolachlor/benoxacor</i>	1.14–1.6 kg/ha		

Soil Applied Grass and Broadleaf Herbicides

DACTHAL W-75 (75 WP)	9–15.5 kg/ha	3.6–6.2 kg/ac	• PPI or PRE. • Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils. • Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils. • Do NOT use on muck soils. • Apply in 250 L/ha (100 L/ac) of water. • Apply immediately after seeding or directly over transplants, preemergence to weeds. • If weeds have emerged, cultivate the soil before application. • Rainfall or irrigation (about 1 cm) is necessary for activation.
<i>chlorthal dimethyl</i>	6.75–11.625 kg/ha		
TREFLAN EC(480 g/L)	1.2–2.4 L/ha	0.5–0.92 L/ac	• PPI. • Use ONLY on direct seeded cabbage or cauliflower or on transplants of cabbage, cauliflower, broccoli and Brussels sprouts.
or RIVAL EC (500 g/L)	1.2–2.3 L/ha	0.48–0.92 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
<i>trifluralin</i>	0.6–1.15 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Postemergence Grass Herbicides			
EXCEL SUPER (80.5 g/L) <i>fenoxaprop-p-ethyl</i>	0.67 L/ha 0.054 kg/ha	0.27 L/ac	• Not registered for use on Brussels sprouts. • Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. • Grasses emerging after application will not be controlled.
POAST ULTRA (450 g/L) plus MERGE <i>sethoxydim</i> plus surfactant/solvent	0.32–1.1 L/ha 1–2 L/ha 0.15–0.5 kg/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Do NOT use on Brussels Sprouts. • Do NOT exceed 0.45 L/ha on broccoli. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Do NOT apply closer than 70 days to harvest.
VENTURE L (125 g/L) <i>fluzifop-p-butyl</i>	0.8–2 L/ha 0.1–0.25 kg/ha	0.32–0.8 L/ac	• Apply POST to actively growing grasses before tillering. • One application per season only. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizome improves control. • Make one application per season. • Do NOT cultivate between rows until 5 days after application.
Postemergence Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE <i>carfentrazone-ethyl</i> plus non-ionic surfactant or surfactant/solvent	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L 8.8–28.1 g/ha 0.25% v/v 0.1% v/v	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
LONTREL 360 (360 g/L) <i>clopyralid</i>	0.56 L/ha 0.20 kg/ha	0.2 L/ac	• Apply POST TRANSPLANT as a ground application ONLY, in 300 L water/ha. • Use ONLY one application per year, no closer than 30 days to harvest. • Use ONLY on transplanted cabbage, cauliflower and broccoli.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
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CARROTS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied followed by Postemergence Grass and Broadleaf Herbicide

TREFLAN EC (480 g/L) or RIVAL EC (500 g/L) or BONANZA 400 (400 g/L) followed by LOROX DF (50 DF)	1.25–2.4 L/ha 1.2–2.2 L/ha 1.5–2.75 L/ha 1.1–3.25 kg/ha	0.5–0.96 L/ac 0.48–0.94 L/ac 0.6–1.1 L/ac 0.44–1.3 kg/ac	• PPI followed by POST. • Use on mineral soils. • Spray linuron when crop has 2 or more fully developed leaves (8–15 cm tall). • Apply POST before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high. • Carrot leaves will become yellow or light green, but they soon recover. • Use nozzle pressure of 175–275 kPa. Do NOT exceed 275 kPa. • Do NOT apply linuron with herbicidal oil. • Do NOT apply linuron during hot, dry weather (greater than 32°C) or when crop is under stress. • Do NOT apply linuron if heavy rains are expected. • Use the lower rates on sandy soils and for smaller weeds. • Do NOT use on coarse-textured soils low in organic matter.
trifluralin followed by linuron	0.6–1.15 kg/ha 0.55–1.625 kg/ha		
GESAGARD 480 SC (480 g/L) followed by LOROX DF (50 DF)	3.75–7.08 L/ha 1.1–3.25 kg/ha	1.5–2.83 L/ac 0.44–1.3 kg/ac	• PRE followed by POST – Use on muck soils ONLY. • For POST – Spray when crop has 2 or more fully developed leaves (8–15 cm tall). • Apply before annual grasses are 5 cm high and broadleaf weeds are 15 cm high. • Carrot leaves will become yellow or light green, but they will soon regain their normal colour. • Do NOT apply during hot, dry weather (greater than 32°C) or when crop is under stress. • Do NOT apply if heavy rains are expected. • Use the lower rates for smaller weeds.
prometryne followed by linuron	1.8–3.4 kg/ha 0.55–1.625 kg/ha		
LOROX DF (50 DF) followed by LOROX DF (50 DF)	1.1–2.25 kg/ha 2.25–4.5 kg/ha	0.44–0.9 kg/ac 0.9–1.8 kg/ac	• PRE followed by POST. • Do NOT apply the 2nd treatment closer than 2 weeks after the first treatment. • Do NOT apply more than 2 applications per season. • Spray POST when crop has 2 or more fully developed leaves (8–15 cm tall). • Apply POST before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high. • Carrot leaves will become yellow or light green, but they soon recover. • Use nozzle pressure of 175–275 kPa. Do NOT exceed 275 kPa. • Do NOT apply with herbicidal oil. • Do NOT apply during hot, dry weather (greater than 32°C) or when crop is under stress. • Do NOT apply if heavy rains are expected. • Use the lower rates on sandy soils and for smaller weeds. • Do NOT use on coarse-textured soils low in organic matter.
linuron followed by linuron	0.55–1.125 kg/ha 1.125–2.25 kg/ha	0.44–0.9 L/ac 0.9–1.8 L/ac	

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Soil Applied Broadleaf Herbicides			
GESAGARD 480 SC (480 g/L)	3.75–7.08 L/ha	1.5–2.83 L/ac	• PRE – apply soon after seeding. • Apply in 200–1,000 L/ha (80–400 L/ac) water. • Use the lower rate on sandy soils and the higher rate on muck soils. • Do NOT use at or near the time of emergence. • Do NOT use for POST use.
<i>prometryne</i>	1.8–3.4 kg/ha		
LOROX DF (50 DF)	1.1–3.25 kg/ha	0.44–1.3 kg/ac	• PRE – Apply as a band or broadcast spray after planting but before carrots emerge. • Apply in 200–350 L/ha (80–140 L/ac) water. • Use the lower rate on sandy soils. • Carrots are very sensitive to this treatment at the time of emergence and severe injury can occur at this time if there is a heavy rain or if the area is irrigated.
<i>linuron</i>	0.55–1.625 kg/ha		
Soil Applied Grass and Broadleaf Herbicide			
TREFLAN EC (480 g/L)	1.2–2.4 L/ha	0.48–0.96 L/ac	• PPI.
or RIVAL EC (500 g/L)	1.2–2.3 L/ha	0.48–0.92 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
<i>trifluralin</i>	0.576–1.15 kg/ha		
Postemergence Grass Herbicide			
EXCEL SUPER (80.5 g/L)	0.67 L/ha	0.27 L/ac	• Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. • Grasses emerging after application will not be controlled. • Do NOT apply if rain is expected within one hour after application.
<i>fenoxaprop-p-ethyl</i>	0.054 kg/ha		
POAST ULTRA (450 g/L)	0.32–1.1 L/ha	0.13–0.45 L/ac	• Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 49 days.
plus MERGE	1–2 L/ha	0.4–0.8 L/ac	
<i>sethoxydim</i>	0.15–0.5 kg/ha		
<i>plus surfactant/solvent</i>	1–2 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69)
VENTURE L (125 g/L) fluzifop-p-butyl	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• Apply when crop is 10 cm in height or less. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application. • Apply other postemergence herbicides separately at least 3 days after VENTURE L.
Postemergence Broadleaf Herbicide			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L 8.8–28.1 g/ha 0.25% v/v 0.1% v/v	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
Postemergence Grass and Broadleaf Herbicides			
LOROX DF (50 DF) linuron	2.25–4.5 kg/ha 1.125–2.25 kg/ha	0.9–1.8 kg/ac	• For carrots not treated with linuron PRE. • Spray when crop has 2 or more fully developed leaves (8–15 cm tall). • Apply before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high. • Carrot leaves will become yellow or light green, but they will soon regain their normal colour. • Use nozzle pressure of 175–275 kPa. Do NOT exceed 275 kPa. • Do NOT apply with herbicidal oil. • Do NOT apply during hot, dry weather (greater than 32°C) or when the crop is under stress.
mineral oil (herbicidal) overall spray rows only undiluted	600–800 L/ha 300–400 L/ha	240–320 L/ac 120–160 L/ac	• Apply as soon as true leaves develop and before carrot roots are thicker than 5 mm. • Later treatments may produce an oil flavour. • Weeds should be less than 10 cm high. • Ragweed, wormwood, and wild carrot are not controlled.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

CELERY

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Postemergence Broadleaf Herbicide

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L
or MERGE	1 L/1,000 L	1 L/1,000 L

carfentrazone-ethyl
plus non-ionic surfactant
or surfactant/solvent

8.8–28.1 g/ha
0.25% v/v
0.1% v/v

- Apply POST with a **HOODED SPRAYER** between the rows.
- Apply to actively growing weeds up to 10 cm tall.
- Apply in a minimum of 100 L/ha (40 L/ac) water.
- **Do NOT** apply closer than 1 day to harvest.
- Apply **ONLY** once per growing season.

Postemergence Grass and Broadleaf Herbicides

GESAGARD 480 SC (480 g/L)	3.75–4.58 L/ha	1.5–1.83 L/ac
prometryne	1.8–2.2 kg/ha	

LOROX DF (50 DF)	1.82–4.51 kg/ha	0.73–1.8 kg/ac
linuron	0.91–1.80 kg/ha	

mineral oil (herbicidal)		
overall spray	600–800 L/ha	240–320 L/ac
rows only undiluted	300–400 L/ha	120–160 L/ac

- **Do NOT** apply until 21 days after transplanting the crop when the celery plants are established.
- Apply in 200–1,000 L/ha (80–400 L/ac) water in the transplanted crop.
- **Do NOT** use on direct seeded crop.
- Preharvest interval is 54 days.
- Apply to transplants as soon as new growth has started. Some temporary discoloration may occur.
- All dosages are expressed as broadcast rates. For band treatment use proportionately less.
- **Do NOT** use on sandy or coarse-textured soils low in organic matter (less than 1%), as crop injury may result.
- Apply as the true leaves develop on the celery, before weeds are 10 cm high.
- Use **ONLY** on outdoor seedbed and **ONLY** if the soil is moist.

ROOT CHICORY

Postemergence Broadleaf Herbicides

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L
or MERGE	1 L/1,000 L	1 L/1,000 L

carfentrazone-ethyl
plus non-ionic surfactant
or surfactant/solvent

8.8–28.1 g/ha
0.25% v/v
0.1% v/v

- Apply POST with a **HOODED SPRAYER** between the rows.
- Apply to actively growing weeds up to 10 cm tall.
- Apply in a minimum of 100 L/ha (40 L/ac) water.
- **Do NOT** apply closer than 1 day to harvest.
- Apply **ONLY** once per growing season.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69)
UPBEET (50 DF) plus AGRAL 90 or AG-SURF	35–70 g/ha 2.5 L/1,000 L	14–28 g/ac 2.5 L/1,000 L	• For the control of velvetleaf in chicory. • Apply POST after emergence of chicory and velvetleaf, but prior to the 4 leaf stage of velvetleaf. • Apply in 300–1,100 L/ha (120–440 L/ac) of water. • Do NOT exceed 70 g/ha per season. • If the lower rate has been used and velvetleaf continues to emerge, repeat application in 2–3 weeks.
triflurosulfuron-methyl plus non-ionic surfactant	17.5–35 g/ha 0.25% v/v		

Postemergence Grass Herbicides

POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Do NOT apply closer than 30 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		

CUCUMBER

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Preplant (Stale Seedbed Technique)

glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	0.75–3.5 L/ha 0.56–2.6 L/ha 0.54–2.5 L/ha 0.5–2.3 L/ha	0.3–1.4 L/ac 0.22–1 L/ac 0.21–1 L/ac 0.2–0.92 L/ac	• Till and fertilize soil in early spring, and then allow weeds to grow. • Spray weeds just before seeding the crop. • Use low rate for small weeds (8 cm), medium rates for weeds 8–15 cm and higher rate for weeds over 15 cm tall. • Apply recommended PRE or POST herbicides to control new flushes of weeds or use mechanical means of control.
glyphosate*	0.267–1.246 kg/ha		

Soil Applied Grass Herbicide

PREFAR (480 g/L)	12–14 L/ha	4.8–5.6 L/ac	• PPI – For mineral soils ONLY. • Incorporate thoroughly into the soil to a depth of 2.5–5 cm.
bensulide	5.75–6.75 kg/ha		

Soil Applied Broadleaf Herbicide

ALANAP (240 g/L)	11–30 L/ha	4.4–12 L/ac	• PRE – Apply after seeding cucumbers, but before weeds emerge. • May also be applied as a POST spray about one month after the preemergence spray when the crop has emerged following a clean cultivation.
naptalam	2.64–7.19 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

Soil Applied Grass and Broadleaf Herbicides

DACTHAL W-75 (75 WP)	9–15.5 kg/ha	3.6–6.2 kg/ac	• PRE. • Apply only when cucumber plants have 4–5 true leaves, are well established and growing conditions are favourable for good plant growth otherwise crop injury may result. • Apply prior to weed seed germination. If weeds have emerged, cultivate the soil before application. • Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils. • Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils. • Do NOT use on muck soils. • Apply in 250 L/ha (100 L/ac) of water. • Rainfall or irrigation (about 1cm) is necessary for activation.
chlorthal dimethyl	6.75–11.625 kg/ha		
PREFAR (480 g/L)	9.5–14 L/ha	3.8–5.6 L/ac	
followed by ALANAP (240 g/L)	9.5–19 L/ha	3.8–7.7 L/ac	
bensulide	4.56–6.75 kg/ha		
followed by naptalam	2.28–4.56 kg/ha		• PREFAR PPI (incorporate to a depth of 2.5–5 cm), followed by ALANAP PRE. • May also be tank-mixed PPI (Do NOT incorporate deeper than 2.5 cm). • Do NOT use on muck soils. • Use the lower rate on light, sandy soils.

Postemergence Broadleaf Herbicide

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L	
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L	
or MERGE	1 L/1,000 L	1 L/1,000 L	
carfentrazone-ethyl	8.8–28.1 g/ha		
plus non-ionic surfactant	0.25% v/v		
or surfactant/solvent	0.1% v/v		

Postemergence Grass Herbicides

POAST ULTRA (450 g/L)	0.32–1.1 L/ha	0.13–0.45 L/ac	• Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Do NOT apply closer than 30 days to harvest.
plus MERGE	1–2 L/ha	0.4–0.8 L/ac	
sethoxydim	0.15–0.5 kg/ha		
plus surfactant/solvent	1–2 L/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	
fluzifop-p-butyl	0.075–0.25 kg/ha		• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizome improves control. • Do NOT cultivate between rows until 5 days after application. • ONLY make one application per season.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

GARLIC

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicides

DACTHAL W-75 (75 WP)	9–18 kg/ha	3.6–7.2 kg/ac	• PRE. • Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils. • Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils. • Apply at a rate of 18 kg/ha (7.2 kg/ac) on heavy clay soils. • Do NOT use on muck soils. • Apply in 250 L/ha (100 L/ac) of water. • Apply immediately after seeding or directly over transplants, preemergence to weeds. • If weeds have emerged, cultivate the soil before application. • Rainfall or irrigation (about 1 cm) is necessary for activation.
chlorthal dimethyl	6.75–13.5 kg/ha		
DEVIRINOL DF (50 DF)	2.24–4.5 kg/ha	0.9–1.8 kg/ac	• PRE – One application per year only, prior to crop and weed emergence. • Use the lower rate on light soils (coarse textured to sandy and sandy loam). • Do NOT apply closer than 60 days to harvest. • Damage to subsequent crops and cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
napropamide	1.12–2.25 kg/ha		

Postemergence Grass Herbicide

POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Do NOT apply closer than 50 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		

Postemergence Broadleaf Herbicides

AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
PARDNER (280 g/L) or BROTEX (240 g/L)	1 L/ha 1.2 L/ha	0.4 L/ac 0.48 L/ac	• Apply to actively growing broadleaf weeds at the 1–4 leaf stage. • Apply in 200–300 L water/ha (80–100 L water/ac). • Apply at 275 kPa. • Use one ground application per year ONLY. • Do NOT use flood jet nozzles. • Do NOT spray at temperatures above 25°C. • Do NOT apply closer than 58 days to harvest.
bromoxynil	0.28 kg/ha 0.29 kg/ha		

GINSENG

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Preplant or Prior to Crop Emergence (Stale Seedbed Technique)

glyphosate (360 g/L)*	2.5 L/ha	1.0 L/ac	• Apply POST to weeds once in the spring but before the crop has emerged above the soil.
or glyphosate (480 g/L)*	1.86 L/ha	0.75 L/ac	• Apply in 50–100 L water/ha.
or glyphosate (500 g/L)*	1.8 L/ha	0.72 L/ac	• Do NOT exceed rate or spray volume as crop injury may result.
or glyphosate (540 g/L)*	1.67 L/ha	0.67 L/ac	• Do NOT contact actively growing ginseng foliage.
			• Do NOT use a fall application in existing/established gardens.
glyphosate*	0.75–0.9 kg/ha		

Postemergence Grass Herbicide

VENTURE L (125 g/L)	0.8–2 L/ha	0.32–0.8 L/ac	• Apply POST up to 3 times/year: early May, late June and/or mid-August. • Apply to actively growing grasses prior to tillering. • Do NOT apply in the year of harvest.
fluzifop-p-butyl	0.075–0.25 kg/ha		

Postemergence Broadleaf Herbicide

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac	• Apply POST with a HOODED SPRAYER between the rows.
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L	• Apply to actively growing weeds up to 10 cm tall.
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L	• Apply in a minimum of 100 L/ha (40 L/ac) water.
or MERGE	1 L/1,000 L	1 L/1,000 L	• Do NOT apply closer than 1 day to harvest.
			• Apply ONLY once per growing season.
carfentrazone-ethyl	8.8–28.1 g/ha		
plus non-ionic surfactant	0.25% v/v		
or surfactant/solvent	0.1% v/v		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

HERBS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicides

DEVIRINOL DF (50 DF)	2.2–4.4 kg/ha	0.88–1.76 kg/ac	• PRE or PPI – Use on basil ONLY. • Apply in 200–900 L/ha (80–360 L/ac) water. • ONLY one application per year. • Do NOT plant non-labeled crops until 12 months after application to avoid injury. • High rates may result in temporary crop stunting or retardation. However, crops will out-grow the injury and yield is unaffected.
napropamide	1.1–2.2 kg/ha		
SINBAR (80 WP)	1.75 kg/ha	0.7 kg/ac	• PRE – Use on peppermint and spearmint ONLY. • Apply once per crop season at the end of September to early October. • Do NOT apply closer than 9 or 10 months to harvest. • Do NOT use on soils with less than 1% organic matter.
terbacil	1.4 kg/ha		

Postemergence Grass Herbicide

POAST ULTRA (450 g/L) plus MERGE	0.32–0.65 L/ha 1–2 L/ha	0.13–0.19 L/ac 0.4–0.8 L/ac	• Use on spearmint and peppermint ONLY. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass suppression, use 0.65 L/ha. Apply up to the 3 leaf stage. Thorough pre-plant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Apply using 110–200 L/ha (44–80 L/ac) water. • Do NOT apply closer than 30 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.29 kg/ha 1–2 L/ha		

LEEKs

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Postemergence Broadleaf Herbicide

AIM EC (240 g/L) plus AGRAL 90	36.5–117 mL/ha 2.5 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L	
or MERGE	1 L/1,000 L	1 L/1,000 L	
carfentrazone-ethyl plus non-ionic surfactant	8.8–28.1 g/ha 0.25% v/v		
or surfactant/solvent	0.1% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
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Postemergence Grass and Broadleaf Herbicide

GESAGARD 480 SC (480 g/L)	3.75 L/ha	1.5 L/ac	• Apply 2 applications 10 days apart, before weeds are 5 cm high. • Make the first application to well-established transplanted leeks that have produced one new fully expanded leaf. • Can be used on either muck or mineral soils. • Do NOT use more than 2 applications a year. • Temporary injury can occur to the lower leaves in some cultivars of leek.
prometryne	1.8 kg/ha		

LETTUCE

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicide

KERB (50 WSP)	2.2 kg/ha	0.83 kg/ac	• For direct seeded lettuce, apply PPI, PRE, or POST after the crop emerges to weed-free soil. • For transplanted lettuce, apply 7–10 days after transplanting to weed-free soil. • Use only once per year. • Do NOT replant lettuce in KERB treated fields in the same year. • Do NOT use on muck soils. • Do NOT apply closer than 55 days to harvest.
propyzamide	1.1 kg/ha		

Postemergence Broadleaf Herbicide

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L	
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L	
or MERGE	1 L/1,000 L	1 L/1,000 L	
carfentrazone-ethyl	8.8–28.1 g/ha		
plus non-ionic surfactant	0.25% v/v		
or surfactant/solvent	0.1% v/v		

MUSKMELON, WATERMELON, SQUASH AND PUMPKIN

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Broadleaf Herbicide

ALANAP (240 g/L)	11–30 L/ha	4.4–12 L/ac	• PRE prior to crop and weed emergence. • Do NOT use on butternut squash, some injury may occur to Table Queen squash. • May be applied to melons (NOT squash or pumpkins) as a POST treatment about one month after the preemergence spray when the crop has emerged but before the weeds are up.
naptalam	2.638–7.194 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Soil Applied Grass Herbicide			
DUAL II MAGNUM (915 g/L)	1.15 L/ha	0.46 L/ac	• For use ONLY in winter squash and pumpkins. • Apply PRE in direct seeded crops prior to weed emergence OR at the 1–2 leaf stage of winter squash or pumpkin but still PRE to weed emergence. • Make only one application per year. • DO NOT harvest within 65 days of treatment. • Reduced control in heavy weed populations may occur.
s-metolachlor/benoxacor	1.05 kg/ha		
Soil Applied Grass and Broadleaf Herbicides			
DACTHAL W-75 (75 WP)	9–15.5 kg/ha	3.6–6.2 kg/ac	• PRE. • Do NOT use on Pumpkins. • Apply only when plants have 4–5 true leaves, are well established and growing conditions are favourable for good plant growth otherwise crop injury may result. • Apply prior to weed seed germination. If weeds have emerged, cultivate the soil before application. • Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils. • Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils. • Do NOT use on muck soils. • Apply in 250 L/ha (100 L/ac) of water. • Rainfall or irrigation (about 1 cm) is necessary for activation.
chlorthal dimethyl	6.75–11.625 kg/ha		
DEVIRINOL DF (50 DF)	2.24–4.5 kg/ha	0.9–1.8 kg/ac	• PRE – one application per season. • Use on direct seeded pumpkin and squash ONLY. • Apply in 200–900 L/ha (80–360 L/ac) water. • Use the lower rate on light soils (coarse textured, sandy or sandy loam). • Shepherd's purse and lady's-thumb may escape treatment at this rate. • Apply before rainfall if irrigation is not available. • Damage to subsequent crops and cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
napropamide	1.12–2.25 kg/ha		
Postemergence Grass Herbicide			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• For pumpkins and squash ONLY. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Do NOT apply closer than 30 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.2 kg/ha 1–2 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
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Postemergence Broadleaf Herbicides

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L
or MERGE	1 L/1,000 L	1 L/1,000 L

- Apply POST with a **HOODED SPRAYER** between the rows.
- Apply to actively growing weeds up to 10 cm tall.
- Apply in a minimum of 100 L/ha (40 L/ac) water.
- **Do NOT** apply closer than 1 day to harvest.
- Apply **ONLY** once per growing season.

carfentrazone-ethyl	8.8–28.1 g/ha
plus non-ionic surfactant	0.25% v/v
or surfactant/solvent	0.1% v/v

ONIONS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Most experience with herbicides below has been with the seeded crop. Experience with sets and limited experience with Spanish onions have been satisfactory. On green bunching onions, the granular formulations (applied when the leaves are dry) are recommended to avoid leaf injury.

Soil Applied Grass and Broadleaf Herbicides

CHATEAU WDG (51.1%)	0.14 kg/ha	0.05 kg/ac
flumioxazin	0.07 kg/ha	

- Apply once per season.
- Apply to transplanted onions between the 2–6 leaf stage and on direct seeded onions between the 3–6 leaf stage prior to weed emergence.
- Apply to all soil types with less than 5% organic matter.
- Apply using ground application **ONLY**.
- **DO NOT** apply through irrigation equipment.
- Severe crop injury will result when soils are flooded or poorly drained following application and/or if applications are made under cool, wet conditions.

DACTHAL W-75 (75 WP)	9–18 kg/ha	3.6–7.2 kg/ac
chlorthal dimethyl	6.75–13.5 kg/ha	

- PRE.
- Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils.
- Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils.
- Apply at a rate of 18 kg/ha (7.2 kg/ac) on heavy clay soils.
- **Do NOT** use on muck soils.
- Apply in 250 L/ha (100 L/ac) of water.
- Apply immediately after seeding or directly over transplants, preemergence to weeds.
- If weeds have emerged, cleanly cultivate the soil before application.
- Rainfall or irrigation (about 1 cm) is necessary for activation.

Postemergence Grass Herbicides

EXCEL SUPER (80.5 g/L)	0.67 L/ha	0.27 L/ac
fenoxaprop-p-ethyl	0.054 kg/ha	

- Apply to annual grasses in the 1–6 leaf stage, or until volunteer corn is 25 cm tall.
- Annual grasses will not be controlled if emergence occurs after application.
- **Do NOT** apply if rain is expected within one hour after application.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
FRONTIER MAX (720 g/L)	1.29 L/ha	0.52 L/ac	• Apply ONLY at the loop stage of onion. • FRONTIER MAX will suppress yellow nutsedge when applied to dry bulb onions grown on muck soils only before yellow nutsedge has emerged. • Apply only once per growing season. • Pre-harvest interval of 60 days.
dimethenamid	0.93 kg/ha		
FRONTIER (900 g/L)	1.87 L/ha	0.75 L/ac	• Apply ONLY at the loop stage of onion. • FRONTIER will provide suppression of yellow nutsedge when applied before yellow nutsedge has emerged. • Apply only once per growing season. • Preharvest interval of 60 days.
dimethenamid	1.68 kg/ha		
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• For dry bulb onions ONLY. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Do NOT apply closer than 50 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
SELECT (240 g/L)	0.125–0.38 L/ha	0.05–0.15 L/ac	• For control of annual blue grass, other annual grasses and quackgrass. • Use 0.38 L/ha to control quackgrass. • See SELECT label for detailed information on rates to control all annual grasses. • Apply when the crop is in the 1–4 leaf stage and the weeds are in the 2–6 leaf stage.
clethodim	0.03–0.09 kg/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Apply in a maximum volume of 300 L/ha (120 L/ac). • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application. • Do NOT apply closer than 42 days before harvest.
fluzafop-p-butyl	0.075–0.25 kg/ha		
Postemergence Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
GOAL 2XL (240 g/L)	0.5 L/ha	0.2 L/ac	• Apply after onions have 2 fully developed leaves. • Apply in minimum of 500 L/ha (200 L/ac) water. • Do NOT exceed a total of 2.0 L/ha (0.8 L/ac) per year.
oxyfluorfen	0.12 kg/ha		
PARDNER (280 g/L)	0.5 L/ha	0.2 L/ac	• For use ONLY on dry bulb onions. • Apply POST to actively growing pigweed and common groundsel up to the 4 leaf stage. • Apply when onions are at the 2–3 leaf stage, repeat application when onions are at the 4–5 leaf stage. • Apply in 200 L/ha (100 L/ac) water at a pressure of 170 kPa (25 psi). • Do NOT harvest within 75 days of application. • PARDNER may cause severe leaf burn in onions if weather conditions have not been conducive to the development of the outer waxy layer of the onion leaf.
bromoxynil	0.14 kg/ha		

Postemergence Grass and Broadleaf Herbicides

PROWL 400 (400 g/L)	2.5–3.75 L/ha	1–1.5 L/ac	• For mineral soils, use on direct seeded dry bulb onions. • Apply at the 2–6 leaf stage of crop development for season long control. • Destroy existing weeds prior to application.
pendimethalin	1–1.5 kg/ha		
PROWL 400 (400 g/L)	7.5 L/ha	3 L/ac	• For muck soils, use on direct seeded dry bulb onions. • Apply at the loop and/or 2 leaf stage of crop development for season long control. • Destroy existing weeds prior to application.
pendimethalin	3 kg/ha		

PARSNIPS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicides

LOROX DF (50 DF)	1.25–2.4 kg/ha	0.5–0.96 kg/ac	• Apply soon after seeding. • Plant seed at least 1.3 cm deep. • Use a rate of 1.25–1.82 kg/ha on loam or clay soil with low organic matter. • Use a rate of 1.82–2.4 kg/ha on muck soil or clay soil with medium organic matter. • Heavy rains or irrigation at time of emergence may cause injury. • An additional postemergence treatment may be needed. • Do NOT apply within 60 days of harvest.
linuron	0.625–1.2 kg/ha		
LOROX DF (50 DF)	1.25–1.82 kg/ha	0.5–0.73 kg/ac	• PRE (maximum 1.82 kg/ha), followed by POST (maximum 2.4 kg/ha). • These treatments must be applied at least 2 weeks apart or crop injury may result. • Do NOT apply more than these 2 applications per season and Do NOT use higher rates. • Observe instructions for both PRE and POST use carefully before using.
followed by LOROX DF (50 DF)	1.25–2.4 kg/ha	0.5–0.96 kg/ac	
linuron	0.625–0.91 kg/ha		
followed by linuron	0.625–1.2 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Postemergence Broadleaf Herbicide

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L
or MERGE	1 L/1,000 L	1 L/1,000 L

carfentrazone-ethyl	8.8–28.1 g/ha
plus non-ionic surfactant	0.25% v/v
or surfactant/solvent	0.1% v/v

- Apply POST with a **HOODED SPRAYER** between the rows.
- Apply to actively growing weeds up to 10 cm tall.
- Apply in a minimum of 100 L/ha (40 L/ac) water.
- **Do NOT** apply closer than 1 day to harvest.
- Apply **ONLY** once per growing season.

Postemergence Grass and Broadleaf Herbicides

LOROX DF (50 DF)	1.82–4.51 kg/ha	0.73–1.80 kg/ac
linuron	0.91–2.26 kg/ha	

- Apply when the crop has 2 or more fully developed leaves.
- Use lower rates on small seedling weeds and higher rates on established weeds.
- On muck soils, parsnips must be more than 8 cm tall when spraying.
- **Do NOT** mix with HERBICIDE OIL or other surfactants.
- Apply in 220–440 L/ha (80–176 L/ac) water.
- Apply before annual grasses exceed 5 cm and before broadleaf weeds exceed 15 cm.
- During hot, dry weather, spray in the cool part of the day to avoid crop injury.
- Nozzle pressure must not exceed 275 kPa (40 psi) as crop injury may result.
- LOROX DF may be applied following carrot oil provided that these treatments are applied at least 1 day apart.
- Carrot oil may be applied following LOROX DF provided that these treatments are applied at least 2 weeks apart. Shorter intervals may cause crop injury.
- If unusually heavy rains follow application, severe injury may result.
- **Do NOT** apply within 60 days of harvest.

mineral oil (herbicidal)		
overall spray	600–800 L/ha	240–320 L/ac
rows only undiluted	300–400 L/ha	120–160 L/ac

- Apply as soon as true leaves develop and before parsnip roots are 5 mm thick.
- Later treatments may produce an oil flavour.
- Weeds should be less than 10 cm high.

PEAS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ac
s-metolachlor/benoxacor	1.14–1.6 kg/ha	

- Apply PRE.
- **Do NOT** use on muck, peat, high organic matter soils or soils with less than 1% organic matter.
- Use the higher rate for heavier weed populations.
- Apply by ground application equipment only.

TREFLAN EC(480 g/L)	1.2–1.7 L/ha	0.5–0.7 L/ac
or RIVAL EC (500 g/L)	1.2–1.6 L/ha	0.9–1.38 L/ac
or BONANZA 400 (400 g/L)	1.5–2 L/ha	0.6–0.8 L/ac

trifluralin	0.6–0.8 kg/ha	
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- Apply PPI. Incorporate within 24 hours of application.
- **Do NOT** exceed the low rate on medium textured soils.
- **Do NOT** apply to peat or muck soils (greater than 15% organic matter).
- **Do NOT** apply to soils with less than 2% organic matter.
- **Do NOT** apply to fields spread with manure within the last 12 months.
- **Do NOT** apply by air.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Soil Applied Broadleaf Herbicide			
GESAGARD 480 (480 g/L)	3.75–4.58 L/ha	1.5–1.83 L/ac	• Apply PRE – Apply before weeds emerge, including Eastern black nightshade. • Apply in 200–1,000 L/ha (80–400 L/ac) water. • Apply only once per year. • Use lower rate on sandy soils. • Preharvest interval is 55 days.
prometryne	1.8–2.2 kg/ha		
Soil Applied Grass and Broadleaf Herbicide			
PURSUIT (240 g/L)	0.312 L/ha	0.125 L/ac	• Apply PPI or PRE. • Apply only once per year. • Allow at least 24 months between PPI applications. • Preharvest interval is 50 days.
imazethapyr	0.075 kg/ha		
Postemergence Grass Herbicide			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply POST to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Do NOT apply herbicides other than MCPA SODIUM 300 or PURSUIT within 4 days of application. • Do NOT graze treated crop. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Use ONLY on fresh or dry processing peas, NOT fresh edible pod peas. • Preharvest interval is 30 days for fresh processing peas. • Preharvest interval is 60 days for dry peas.
sethoxydim surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
Postemergence Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
BASAGRAN (480 g/L) plus SUPER SPREADER or ASSIST	1.75–2.25 L/ha 1.25–2.5 L/1,000 L 1–2 L/ha	0.7–0.9 L/ac 1.25–2.5 L/1,000 L 0.4–0.8 L/ac	• Apply POST when peas have at least 3 pairs of leaves. • Under hot, humid conditions reduce ASSIST oil concentrate to 1 L/ha (0.4 L/ac). • For snow peas, use the low rate of 1.75 L/ha (0.7 L/ac) and apply only once per year. • Refer to the BASAGRAN label for information on specific weed stage and height. • Two applications, 10 days apart, of 1.75 L/ha (0.7 L/ac) may be required for top growth control of nutsedge and Canada thistle, and suppression of field bindweed. • Do NOT apply if rain is expected within 6 hours after application. • Preharvest interval is 30 days for snow peas.
bentazon plus surfactant or oil concentrate	0.84–1.08 kg/ha 0.125%–0.25% v/v		
MCPA SODIUM 300 (300 g/L)* or MCPA AMINE (500 g/L)*	1.25 L/ha 0.7 L/ha	0.5 L/ac 0.28 L/ac	• Apply POST when peas are 10–15 cm high. • Do NOT apply after flower buds have formed on peas. • Do NOT apply when temperatures are over 27°C, high humidity, or under drought conditions. • Do NOT apply by air.
MCPA* or MCPA*	0.38 kg/ha 0.35 kg/ha		
TROPOTOX PLUS (400 g/L) or CLOVITOX PLUS (400 g/L) or TOPSIDE (400 g/L)	2.75–4.25 L/ha	1.1–1.7 L/ac	• Apply POST when peas have 3–6 expanded leaves. • Do NOT apply after the 6 leaf stage as damage may occur. • Do NOT apply when temperatures are over 27°C, high humidity, or under drought conditions. • Do NOT apply by air. • Do NOT graze or cut treated crop for forage. • TOPGROWTH ONLY: Canada thistle, creeping buttercup, field bindweed, horsetail, perennial sow-thistle, tall buttercup.
MCPB/MCPA	1.1–1.7 kg/ha		

PEPPERS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

All treatments should be applied in 150–300 L/ha (60–120 L/ac) water. Discussion of cultural methods can be found in the *Tomatoes (Transplanted)* section, page 244. Weed control in peppers is best accomplished by combining chemical and cultural methods.

Soil Applied Grass Herbicide

TREFLAN EC(480 g/L) or RIVAL EC (500 g/L) or BONANZA 400 (400 g/L)	1.2–2.4 L/ha 1.2–2.3 L/ha 1.5–2.75 L/ha	0.5–0.96 L/ac 0.48–0.92 L/ac 0.6–1.1 L/ac	• Apply PPI. Incorporate within 24 hours of application. • Do NOT exceed the low rate on medium textured soils. • Do NOT apply to peat or muck soils (greater than 15% organic matter). • Do NOT apply to soils with less than 2% organic matter. • Do NOT apply to fields spread with manure within the last 12 months. • Do NOT apply by air. • Do NOT apply on the same land for 2 consecutive years.
trifluralin	0.58–1.15 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Soil Applied Grass and Broadleaf Herbicides			
DUAL II MAGNUM (915 g/L)	1.15–1.25 L/ha	0.46–0.5 L/ac	• Apply within 48 hours of transplanting Bell Peppers and PREEMERGENCE to weeds. • Risk of crop injury increases with early transplanting and soil temperatures below 10°C. • Applications made more than 48 hours after transplanting may increase the risk of foliar injury. • Do NOT harvest Bell peppers within 80 days of application. • Do NOT apply to soils that contain less than 1% or more than 10% organic matter. • Make only one application per year. • Apply in a minimum spray volume of 150 L/ha of water.
<i>s-metolachlor/benoxacor</i>	1.05–1.14 kg/ha		
DACTHAL W-75 (75 WP)	9–15.5 kg/ha	3.6–6.2 kg/ac	• PRE. • Apply 4–6 weeks after transplanting. • Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils. • Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils. • Do NOT use on muck soils. • Apply in 250 L/ha (100 L/ac) of water. • If weeds have emerged, cultivate the soil before application. • Rainfall or irrigation (about 1 cm) is necessary for activation.
<i>chlorthal dimethyl</i>	6.75–11.625 kg/ha		
DEVIRINOL DF (50 DF)	2.25–4.5 kg/ha	0.9–1.8 kg/ac	• Apply PPI. Incorporate within 24 hours of application. • Do NOT apply to soils with over 10% organic matter. • Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
<i>napropamide</i>	1.12–2.25 kg/ha		
Postemergence Grass Herbicide			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Do NOT apply closer than 30 days to harvest.
<i>sethoxydim</i> plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicide			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

POTATOES

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

The best weed management system for potato uses a combination of chemical weed control with cultivation and other techniques. See Chapter 1, *Principles Of Integrated Weed Management*, page 1. Cultivation prior to potato emergence using various kinds of cultivation equipment (light harrows, finger weeder, hillers, etc.) will control the early flush of weeds. Root pruning of the crop should be minimized. If the crop is hilled after application of herbicides, untreated soil will surface and another flush of weeds may result.

• **POTATO VINE KILLING** – For information on products and rates of application of vine killing, consult OMAFRA Publication 363, *Vegetable Production Recommendations*, and follow the product label.

Soil Applied Grass Herbicides			
DUAL II MAGNUM (915 g/L) s-metolachlor/benoxacor	1.25–1.75 L/ha 1.14–1.6 kg/ha	0.5–0.7 L/ac	• PRE or PPI (for nutsedge control). • Do NOT use on the variety Superior. • Do NOT apply on sandy or coarse textured soils low in organic matter. • Do NOT apply at ground crack or if potatoes have emerged.
EPTAM (800 g/L) EPTC	4.25–8.5 L/ha 3.4–6.8 kg/ha	1.7–3.4 L/ac	• PPI – Apply to a dry soil surface before planting and incorporate immediately, at next to the last or last cultivation for grass escapes. Use at 1.7–2.2 L/ac. • Avoid wet soil conditions or weed control may be poor. • Use 2.2–3.4 L/ac rates for heavy weed infestations and nutsedge control.
Soil Applied Broadleaf Herbicides			
LOROX DF (50 DF) linuron	2.2–4.3 kg/ha 1.1–2.16 kg/ha	0.88–1.72 kg/ac	• PRE – Apply immediately after hilling but the potato tops must be covered with soil to avoid injury. • Use the lower rate on light sandy soils and the higher rate on muck or clay soils.
SENCOR 480 F (480 g/L) metribuzin	1.2–2.2 L/ha 0.6–1.1 kg/ha	0.48–0.88 L/ac	• PRE – Apply after hilling before emergence of crop or weeds, or POST before weeds are 4 cm tall. • Use the lower rate on sandy soil. • Do NOT use on muck soils. • Do NOT use on Belleisle, Tobique, or red skinned varieties. • Do NOT exceed a total application rate of 1.1 kg active/ha.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SENCOR 75 DF (75 WG) plus LOROX L (480 g/L)	0.84–1.1 kg/ha 1.5–3.59 L/ha	0.34–0.44 kg/ac 0.6–1.44 L/ac	• PRE – Apply after hilling and before emergence of the crop, or POST before weeds are 4 cm tall. • Use the lower rate on sandy soils. • Use the higher rate on late potatoes for season long control. • Do NOT use on muck soils. • Do NOT use on Belleisle, Tobique, or red skinned varieties.
metribuzin plus linuron	0.63–0.825 kg/ha 0.72–1.728 kg/ha		
Soil Applied Grass and Broadleaf Herbicide			
CHATEAU WDG (51.1%)	0.105 kg/ha	0.042 kg/ac	• DO NOT apply after cracking. • Apply once per season after hilling for the preemergence suppression of labeled weeds. • A minimum of 5 cm of soil must cover the potato plants at the time of application. • Apply to all soil types with less than 5% organic matter. • Apply using ground application ONLY . • DO NOT apply through irrigation equipment. • Crop Injury may occur if applied at hilling.
flumioxazin	0.054 kg/ha		
Soil Applied Tank-Mix Options			
DUAL II MAGNUM (915 g/L) plus LOROX DF (50 DF)	1.25–1.75 L/ha 1.75–2.25 kg/ha	0.5–0.7 L/ac 0.7–0.9 kg/ac	• PRE – Apply after first hilling before emergence of the crop and weeds. • See Precautions for DUAL II MAGNUM and for LOROX DF above.
s-metolachlor/benoxacor plus linuron	1.14–1.6 kg/ha 0.88–1.12 kg/ha		
DUAL II MAGNUM (915 g/L) plus SENCOR 480 F (480 g/L)	1.25–1.75 L/ha 1.1–2.25 L/ha	0.5–0.7 L/ac 0.44–0.9 L/ac	• PPI or PRE – Apply after the first hilling before emergence of the crop and weeds. • See Precautions for DUAL II MAGNUM above. • Do NOT use on Superior, Belleisle, or Tobique potatoes. • Do NOT apply on sandy or on coarse textured soils low in organic matter, or on muck soils. • Do NOT apply at ground crack or if potatoes have emerged.
s-metolachlor/benoxacor plus metribuzin	1.14–1.6 kg/ha 0.55–1.125 kg/ha		
EPTAM (800 g/L) plus SENCOR 480 F (480 g/L)	4.25–5.5 L/ha 1.1–1.75 L/ha	1.7–2.2 L/ac 0.44–0.7 L/ac	• PPI. • Apply as a tank-mix in 220–330 L/ha (88–132 L/ac) water and incorporate immediately. • Do NOT use on muck soils. • Do NOT use on Belleisle or Tobique varieties.
EPTC plus metribuzin	3.4–4.4 kg/ha 0.55–0.875 kg/ha		
Non-Selective Herbicides and Tank-Mix Options			
GRAMOXONE (200 g/L)	3–4.25 L/ha	1.2–1.7 L/ac	• Apply in 275–550 L/ha (150–220 L/ac) water to emerged weeds. • Use on Netted Gem and Cherokee varieties before emergence. Apply on other varieties until 25–30% of the crop has emerged but none of the tops should be over 5–8 cm in height. Temporary yellowing on the tops will occur. • Do NOT use on emerged potato plants in the evening, under cloudy conditions or when the plants are under moisture stress.
paraquat	0.6–0.85 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Apply in 110–330 L/ha (44–132 L/ac) of water at no later than ground crack of the crop.
<i>glufosinate ammonium</i>	0.405–0.75 kg/ha		• Only emerged weeds will be controlled.
IGNITE (150 g/L) plus SENCOR 480 F (480 g/L)	2.7–5 L/ha 1.1 L/ha	1.08–2 L/ac 0.44 L/ac	• POST – Apply in 110–330 L/ha (44–132 L/ac) of water at no later than ground crack of the crop.
<i>glufosinate ammonium</i> plus <i>metribuzin</i>	0.405–0.75 kg/ha 0.55 kg/ha		• Only emerged weeds will be controlled. • Do NOT use metribuzin on muck soils or on Belleisle or Tobique varieties.
Postemergence Grass Herbicides			
EXCEL SUPER (80.5 g/L)	0.67 L/ha	0.27 L/ac	• Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall.
<i>fenoxaprop-p-ethyl</i>	0.054 kg/ha		• Do NOT apply if rainfall is expected within one hour after application. • Grasses emerging after application will not be controlled.
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply to actively growing grasses.
<i>sethoxydim</i> surfactant/solvent	0.15–5 kg/ha 1–2 L/ha		• For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Do NOT apply closer than 80 days to harvest.
SELECT (240 g/L) plus AMIGO	0.13–0.38 L/ha 5–10 L/1,000 L water	0.05–0.15 L/ac 5–10 L/1,000 L water	• Potatoes are tolerant at any growth stage.
<i>clethodim</i> plus surfactant	0.03–0.09 kg/ha 0.5–1% v/v		• For annual grasses and volunteer cereals, apply at the 2–6 leaf stage. • For quackgrass, apply at the 2–5 leaf stage at the higher rate.
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply POST to actively growing grasses before tiling.
<i>flazifop-p-butyl</i>	0.075–0.25 kg/ha		• Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Apply in a maximum volume of 300 L/ha (120 L/ac). • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application. • Do NOT apply closer than 90 days to harvest. • May be tank-mixed with metribuzin.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicide			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
Postemergence Grass and Broadleaf Herbicides			
PRISM (25DF) plus AGRAL 90 or AG-SURF	60 g/ha 2 L/1,000 L water	24 g/ac 2 L/1,000 L water	• Apply when quackgrass is at 3–6 leaf stage (less than 10 cm tall), annual grasses are at 1–6 leaf stage and redroot pigweed is in the 4–6 leaf stage. • Apply before potatoes initiate flowering. • Do NOT apply within 30 days of harvest. • Always add water soluble packages to clean water with the agitator running.
rimsulfuron plus non-ionic surfactant	15 g/ha 0.2% v/v		
SENCOR 480 F (480 g/L) metribuzin	1.2–2.2 L/ha 0.6–1.1 kg/ha	0.48–0.88 L/ac	• Apply soon after potatoes emerge and before weeds are 4 cm high. • Apply in the afternoon or early evening on sunny days to allow the enzyme that detoxifies metribuzin to build-up. • Do NOT use on red skinned varieties. • Do NOT use on potatoes grown for the early market. • Do NOT use on Shepody or Atlantic potatoes. • Do NOT use on muck soil to avoid injury on subsequent crops.
Preharvest			
AIM EC (240 g/L) plus non-ionic surfactant or MERGE	73–350 mL/ha 2.5 L/1,000 L 10 L/1,000 L	30–140 mL/ac 2.5 L/1,000 L 10 L/1,000 L	• Coverage of weed and crop foliage is essential for control. • Apply at a minimum water volume of 100 L/ha (40 L/ac). • Pre Harvest Interval (PHI) is 7 days. • If a second burndown application is required, use REGLONE DESSICANT at the rates listed below.
carfentrazone-ethyl plus non-ionic surfactant or MERGE	17.5–84 g/ha 0.25% v/v 0.1% v/v		
REGLONE DESSICANT (240 g/L) diquat	1.25–3.5 L/ha 0.3–0.84 kg/ha	0.5–1.4 L/ac	• Use 1.25–3.5 L/ha by ground and 1.7–2.3 L/ha for aerial applications. • Use a minimum of 550 L/ha of spray volume. • Use the higher rate for heavy canopy of crop and weeds. • Do NOT apply to drought stressed potatoes. • Do NOT apply if rain is expected within 15 minutes after application.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23, and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
RUTABAGAS			

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ac	• Apply PPI or PRE. PPI gives optimal control of yellow nutsedge; PRE gives optimal control of Eastern black nightshade.
s-metolachlor/benoxacor	1.14–1.6 kg/ha		• Do NOT use on muck, peat and high organic matter soils.
			• Do NOT use on soils with less than 1% organic matter.
			• Use the higher rate for heavier weed populations.
			• Apply by ground application equipment only.
TREFLAN EC (480 g/L)	1.2–2.4 L/ha	0.48–0.96 L/ac	• Apply PPI. Incorporate within 24 hours of application.
or RIVAL EC (500 g/L)	1.6–2.2 L/ha	0.64–0.94 L/ac	• Do NOT exceed the low rate on medium textured soils.
or BONANZA 400 (400 g/L)	2–2.75 L/ha	0.8–1.1 L/ac	• Do NOT apply to peat or muck soils (greater than 15% organic matter).
			• Do NOT apply to soils with less than 2% organic matter.
trifluralin	0.6–1.155 kg/ha		• Do NOT apply to fields spread with manure within the last 12 months.
			• Do NOT apply by air.
			• Do NOT apply on the same land for 2 consecutive years.

Soil Applied Grass and Broadleaf Herbicide

DEVIRINOL DF (50 DF)	2.25–4.5 kg/ha	0.9–1.8 kg/ac	• Apply PPI. Incorporate within 24 hours of application.
			• Use the lower rate on sandy soils.
napropamide	1.12–2.25 kg/ha		• Do NOT apply to soils with over 10% organic matter.
			• Damage to subsequent cover crops can be reduced by tillage across the rows after harvest.
			• Preharvest interval is 60 days.

Postemergence Grass Herbicides

ASSURE II (96 g/L) plus SURE-MIX	0.38–0.75 L/ha 5 L/1,000 L	0.15–0.3 L/ac 5 L/1,000 L	• Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage, and volunteer corn and quackgrass in the 2–6 leaf stage.
quizalofop-p-ethyl plus oil concentrate	0.036–0.07 kg/ha 0.5% v/v		• Use the 0.38 L/ha (0.15 L/ac) rate of ASSURE II for control of volunteer corn, volunteer cereals and green foxtail.
			• The 0.5 L/ha (0.2 L/ac) rate of ASSURE II will suppress quackgrass and also control barnyard grass.
			• Use the 0.75 L/ha (0.3 L/ac) rate of ASSURE II for control of quackgrass.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
VENTURE L (125 g/L) fluzifop-p-butyl	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform emergence. Cultivate 7 days after treatment in wide row crops. • Apply in a maximum volume of 300 L/ha (120 L/ac). • Do NOT cultivate between rows until 5 days after application. • Apply ONLY once per season. • Do NOT apply other herbicides within 3 days of VENTURE L application. • Do NOT apply if rain is expected within 2 hours after application. • Preharvest interval is 45 days.

Postemergent Broadleaf Herbicides

AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L 8.8–28.1 g/ha 0.25% v/v 0.1% v/v	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
LONTREL 360 (360 g/L) clopyralid	0.56 L/ha 0.2 kg/ha	0.22 L/ac	• Apply POST when ragweed is 5–10 cm tall. • Make ONLY one application per year. • Do NOT apply by air. • Do NOT apply if rain is expected within 4 hours after application. • Preharvest interval is 83 days.

SPECIALTY VEGETABLES: CHINESE BROCCOLI, RADISH AND CABBAGE, KOHLRABI, MUSTARD CABBAGE, FUZZY SQUASH, SNOW PEAS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicides

DEVIRINOL DF (50 DF) napropamide	2.25–4.5 kg/ha 1.12–2.25 kg/ha	0.9–1.8 kg/ac	• PRE or PREPLANT – For use ONLY on seeded Chinese broccoli, mustard, cabbage, Chinese radish, Chinese mustard cabbage, Chinese cabbage, transplanted Chinese cabbage and kohlrabi. • Use the lower rate on light soils (coarse textured to sandy and sandy loam). • ONLY one application per year. Ground application ONLY. • Do NOT apply closer than 60 days to harvest. • After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. • Small grains seeded in the fall may be stunted but not otherwise affected.
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TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
DEVIRINOL DF (50 DF)	3 kg/ha	1.2 kg/ac	• PPI – For use on fuzzy squash transplants ONLY. • Requires rainfall or sufficient irrigation to wet the soil to a depth of 5–10 cm soon after application. • Some crop stunting may be observed but this should not affect yield.
napropamide	1.5 kg/ha		
PURSUIT (240 g/L)	0.312 L/ha	0.125 L/ac	• PRE – For use on snow peas ONLY. • Apply ONLY once per year. • Apply in 200 L/ha (80 L/ac). • Do NOT apply closer than 60 days to harvest.
imazethapyr	0.075 kg/ha		
Postemergence Grass Herbicide			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• For use ONLY on Chinese broccoli, Chinese cabbage, kohlrabi, mustard cabbage and Chinese radish and snow peas. • Apply to actively growing grasses. • Apply using 110–200 L/ha (44–80 L/ac) water volume. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use the 0.32 L/ha rate ONLY for snow peas. • Do NOT apply closer than 30 days to harvest.
sethoxydim	0.15–0.5 kg/ha		
plus surfactant/solvent	1–2 L/ha		
Postemergent Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
BASAGRAN (480 g/L) plus ASSIST	1.75 L/ha 1–2 L/ha	0.7 L/ac 0.4–0.8 L/ac	• For snow peas ONLY. • Apply after the crop is at the 3 leaf stage when weeds are small and actively growing. • Use ONLY one application per year. • Apply in 300 L water/ha. • Do NOT apply closer than 30 days to harvest.
bentazon plus oil concentrate	0.84 kg/ha		
LONTREL 360 (360 g/L)	0.56 L/ha	0.2 L/ac	• For use ONLY on Nappa cabbage, Chinese radish, mustard cabbage, and Chinese broccoli. • Treat when weeds are young and actively growing. • Apply as a ground application in 300 L water/ha. • Use ONLY one application per year. • Do NOT apply closer than 30 days to harvest. • Will not control weeds that emerge after treatment.
clopyralid	0.20 kg/ha		

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

SPINACH

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Postemergence Grass Herbicides

POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply to actively growing grasses. One application per year. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 15 days.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		

Postemergence Broadleaf Herbicide

AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
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SUGAR BEETS (PROCESSING)

Caution about Herbicide Residues – Sugar beets are one of the most sensitive crops to herbicide residues from the previous year's crop. They are particularly sensitive to residues from many of the Group 2 herbicides, including PURSUIT, BROADSTRIKE, CLASSIC and PEAK. Low soil pH (below 6.0) or high soil pH (above 7.5) can be a factor to delay the breakdown of these herbicides, increasing crop injury in rotational crops. Please see Table 4-4, *Herbicide Crop Rotation and Soil pH Restrictions*, on page 61, as well as product labels and your herbicide and sugar company representatives for more details on your situation.

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Broadleaf Herbicide

PYRAMIN FL (430 g/L)	8.25–10.25 L/ha	3.3–4.1 L/ac	• Apply PPI or PRE. • Do NOT incorporate more than 5 cm deep. • Do NOT apply to soils with less than 3% organic matter.
pyrazon	3.55–4.41 kg/ha		

Soil Applied Grass and Broadleaf Herbicide

NORTRON SC (480 g/L)	3.2–8.25 L/ha	1.28–3.3 L/ac	• Apply PPI or PRE. • Do NOT incorporate more than 5 cm deep. • Use ONLY on mineral soils. • Use the lower rate on soils with less than 3% organic matter. • Do NOT rotate to other crops for 12 months.
ethofumesate	1.54–3.96 kg/ha		

Soil Applied Tank-Mix Option

PYRAMIN FL (430 g/L) plus NORTRON SC (480 g/L)	5.25 L/ha 3.65 L/ha	2.1 L/ac 1.46 L/ac	• Apply PRE. • Do NOT apply to soil with less than 3% organic matter. • Apply ONLY once per year. • Use ONLY on mineral soils. • Do NOT rotate to crops other than sugar beets for 12 months.
pyrazon plus ethofumesate	2.26 kg/ha 1.75 kg/ha		

Postemergence Grass Herbicides

ASSURE II (96 g/L) plus SURE-MIX	0.38–0.75 L/ha 5 L/1,000 L water	0.15–0.30 L/ac 5 L/1,000 L water	• Apply POST when annual grasses and volunteer cereals are in the 2 leaf to tillering stage and volunteer corn and quackgrass are in the 2–6 leaf stages. • Apply before the crop canopy closes to maximize spray coverage. • Use the 0.38 L/ha (0.15 L/ac) rate for annual grasses and volunteer cereals. • Use the 0.75 L/ha (0.30 L/ac) rate for quack grass. • Use a second application of 0.38 L/ha (0.15 L/ac) to control late emerging weeds. • Do NOT exceed an accumulative seasonal use rate of 0.75 L/ha (0.30 L/ac). • Do NOT use flood jet nozzles. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 80 days.
quizafofop-p-ethyl plus oil concentrate	0.036–0.072 kg/ha 0.5% v/v		
DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ha	• Apply postemergent to sugarbeets between the 2–4 leaf stage and before weed emergence. • Do not apply more than one application per season. • Preharvest interval is 120 days. • Do NOT feed sugar beet tops to livestock.
s-metolachlor/benoxacor	1.15–1.6 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply POST to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Do NOT graze treated crop. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Do NOT apply herbicides other than LONTREL 360 within 4 days of application. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 85 days.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		

Postemergence Broadleaf Herbicides

AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
BETAMIX β EC ((1:1)153 g/L) desmedipham/phenmedipham	Consult label and your processor for application rates.		• Apply POST when sugar beets have at least 2 true leaves. • Apply before the weeds have 4 true leaves (before 2 true leaves is optimum). • Wait a minimum of 7 days before making a second application. • Consult label for split (reduced rate) applications. • Do NOT spray in excess of a total of 16.5 L/ha of BETAMIX per year. • Do NOT spray under extreme temperature or drought conditions. • Do NOT spray if dew is present. • Yellowing of the crop may occur, but sugar beets will recover. • Do NOT spray if rainfall is expected within 6 hours. • Preharvest interval is 60 days.
LONTREL 360 (360 g/L) clopyralid	Consult label and your processor for application rates.		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
PYRAMIN FL (430 g/L) pyrazon	Consult label and your processor for application rates.		• Apply POST when first true leaf of sugar beets is at least 2.5 cm long. • Do NOT apply when beets are in the cotyledon stage. • Apply before the weeds have 3 true leaves. • Do NOT use on soils with less than 3% organic matter. • Avoid hot temperatures. • Apply using a minimum of 300 L/ha of water.
UPBEET (50 DF) plus AGRAL 90 or SURE-MIX triflusulfuron-methyl plus non-ionic surfactant or plus adjuvant	35–70 g/ha 2.5 L/1,000 L water 2.5 L/1,000 L water 17.5–35 g/ha 0.25% v/v 0.25% v/v	14–28 g/ac 2.5 L/1,000 L water 2.5 L/1,000 L water 17.5–35 g/ha 0.25% v/v 0.25% v/v	• Apply POST when sugar beets are actively growing. • Yellowing of the crop may occur, but sugar beets will recover. • Make 2 applications 5–10 days apart when velvetleaf has fewer than 2 leaves. • Use the higher rate for larger weeds and heavy weed populations. • Do NOT use more than 100 g/ha (40 g/ac) of UPBEET in a season. • Do NOT apply under extreme temperatures or drought conditions. • Do NOT spray if rainfall is expected within 6 hours. • Preharvest interval is 60 days.
Postemergence Tank-Mix Option			
UPBEET (50 DF) BETAMIX ((1:1)150 g/L) triflusulfuron-methyl plus desmedipham/ phenmedipham	35–70 g/ha 1.75–3.5 L/ha 17.5–35 g/ha 0.26–0.53 g/ha	14–28 g/ac 0.7–1.4 L/ac 17.5–35 g/ha 0.26–0.53 g/ha	• Apply POST when sugar beets are actively growing. • Yellowing of the crop may occur, but sugar beets will recover. • Make 2 applications 5–10 days apart, or as weeds emerge, to weeds with fewer than 4 true leaves. Best control is obtained if weeds have less than 2 leaves. • Use the higher rate for larger weeds and heavy weed populations. • If velvetleaf is the predominant weed, use of UPBEET alone with an adjuvant is preferable. • Do NOT use an adjuvant with this tank-mix. • Do NOT use more than 100 g/ha (40 g/ac) of UPBEET in a season. • Do NOT apply under extreme temperature or drought conditions. • Do NOT spray if dew is present. • Do NOT spray if rainfall is expected within 6 hours. • Preharvest interval is 60 days.
Glyphosate Tolerant ("Roundup Ready") Varieties Only			
ROUNDUP ULTRA2 (540 g/L) or ROUNDUP WEATHERMAX (540 g/L) glyphosate	0.83–1.67 L/ha 0.432–0.9 kg/ha	0.332–0.67 L/ac	• Use ONLY on pedigreed (certified) sugarbeet seed designated as glyphosate tolerant (i.e. "Roundup Ready"). • Apply to emerged weeds up to 15 cm in height. • A maximum of 4 applications may be applied to glyphosate tolerant sugarbeets in one season. Allow a minimum of 10 days between applications. • Do NOT harvest sugarbeets within 30 days of the final glyphosate application.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

SWEET POTATOES

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil applied Grass and Broadleaf Herbicides

COMMAND 360 ME (360 g/L)	1.55 L/ha	0.62 L/ac	• Apply as a single application post transplant surface applied to the crop and prior to weed emergence.
clomazone	0.558 kg/ha		• Apply in a minimum of 95 L/ha (38 L/ac) of water.
			• Do NOT apply closer than 95 days to harvest.
DACTHAL W-75 (75 WP)	9–18 kg/ha	3.6–7.2 kg/ac	• PRE.
chlorthal dimethyl	6.75–13.5 kg/ha		• Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/ac) on light sand or sandy loam soils.
			• Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/ac) on medium silt loam soils.
			• Apply at a rate of 18 kg/ha (7.2 kg/ac) on heavy clay soils.
			• Do NOT use on muck soils.
			• Apply in 250 L/ha (100 L/ac) of water.
			• Apply directly over transplants, preemergence to weeds.
			• If weeds have emerged, cleanly cultivate the soil before application.
			• Rainfall or irrigation (about 1 cm) is necessary for activation.

Postemergence Broadleaf Herbicide

AIM EC (240 g/L)	36.5–117 mL/ha	14.8–47 mL/ac	• Apply POST with a HOODED SPRAYER between the rows.
plus AGRAL 90	2.5 L/1,000 L	2.5 L/1,000 L	• Apply to actively growing weeds up to 10 cm tall.
or AG-SURF	2.5 L/1,000 L	2.5 L/1,000 L	• Apply in a minimum of 100 L/ha (40 L/ac) water.
or MERGE	1 L/1,000 L	1 L/1,000 L	• Do NOT apply closer than 1 day to harvest.
			• Apply ONLY once per growing season.
carfentrazone-ethyl	8.8–28.1 g/ha		
plus non-ionic surfactant	0.25% v/v		
or surfactant/solvent	0.1% v/v		

Postemergence Grass and Broadleaf Herbicide

POAST ULTRA (450 g/L)	0.32–1.1 L/ha	0.13–0.45 L/ac	• Apply to actively growing grasses.
plus MERGE	1.0–2.0 L/ha	0.4–0.8 L/ac	• Apply using 110–200 L/ha (44–80 L/ac) water volume.
			• For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage.
sethoxydim	0.15–0.5 kg/ha		• For volunteer grains, use 0.47 L/ha.
plus surfactant/solvent	1–2 L/ha		• For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass.
			• Do NOT apply closer than 30 days to harvest.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23
and Chapter 5. *Notes on Adjuvants*, page 69).

TOMATOES (TRANSPLANTED)

Weed control in tomatoes usually consists of a combination of chemical weed control and cultivation. Crop rotation is also beneficial in the control of weeds. Cultivation should be shallow to prevent bringing untreated soil to the surface, which may result in another flush of weeds. When tomatoes are grown on raised beds and beds are reshaped during the course of the season, it may be necessary or useful to apply another herbicide treatment to areas between the rows to prevent a new weed infestation from interfering with harvesting. Do not exceed the total recommended rate per season of any herbicide applied more than once per year. Band treatment of herbicides over the row will reduce the cost by one-half to two-thirds depending on the width of the band compared to the row spacing. Shallow inter-row cultivation will be required for weed control between the rows. Perennial weeds may be partially controlled by cultivation. Controlling perennial weeds in crops other than tomatoes when grown in rotation is the best approach to control. Perennials are easily spread with cultivators or tillage equipment. Till areas of perennial weeds last. Machinery sanitation is important when moving between fields.

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Apply all treatments in 150–300 L/ha (60–120 L/ac) water unless otherwise specified.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply PPI. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing tomato roots. • Do NOT use on muck, peat, high organic matter soils. • Do NOT use on soils with less than 1% organic matter. • Use the higher rate for heavier weed populations, Eastern black nightshade and yellow nutsedge.
s-metolachlor/benoxacor	1.14–1.6 kg/ha		
TREFLAN EC (480 g/L)	1.2–2.4 L/ha	0.48–0.96 L/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply PPI. Incorporate within 24 hours of application. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. • Cool, wet weather may delay transplant establishment but yield is not usually affected. • Do NOT apply to peat or muck soils (greater than 15% organic matter). • Do NOT apply to soils with less than 2% organic matter. • Do NOT apply to fields spread with manure within the last 12 months. • Do NOT apply by air.
or RIVAL EC (500 g/L)	1.2–2.3 L/ha	0.48–0.94 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
trifluralin	0.6–1.15 kg/ha		

Soil Applied Grass and Broadleaf Herbicides

DEVIRINOL DF (50 DF)	2.25–4.5 kg/ha	0.9–1.8 kg/ac	• Apply PPI. Incorporate within 24 hours of application. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. • Registered for use on field seeded and transplanted tomatoes. • Use the lower rates on light textured soils. • Do NOT apply to soils with over 10% organic matter. • Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
napropamide	1.12–2.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
DUAL II MAGNUM (915 g/L) SENCOR 480 F (480 g/L)	1.25–1.75 L/ha 0.5–1.4 L/ha	0.5–0.7 L/ac 0.2–0.56 L/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply PPI. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. • Do NOT use on muck, peat, or high organic matter soils. • Do NOT use on soils with less than 2% organic matter. • Use the higher rate of DUAL II MAGNUM for heavier weed populations, Eastern black nightshade and yellow nutsedge. • Use lower rate of metribuzin and repeat applications of metribuzin when the crop is established as described under postemergence application of metribuzin. • Do NOT exceed total maximum rate of metribuzin recommended for your soil type.
s-metolachlor/benoxacor plus metribuzin	1.14–1.6 kg/ha 0.25–0.7 kg/ha		
TREFLAN EC (480 g/L) plus DUAL II MAGNUM (915 g/L) plus SENCOR 500 F (500 g/L)	1.1–2.1 L/ha 1–1.25 L/ha 0.5–1 L/ha	0.44–0.84 L/ac 0.4–0.5 L/ac 0.2–0.4 L/ac	
trifluralin plus s-metolachlor/benoxacor plus metribuzin	0.53–1 kg/ha 0.92–1.14 kg/ha 0.25–0.5 kg/ha		• Use ONLY on transplant tomatoes grown for processing. • Apply PPI. Incorporate within 24 hours of application. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. • Do NOT use on muck, peat or high organic matter soils (greater than 15% organic matter). • Use the lower rates on light textured soils. • Use lower rate of metribuzin and repeat applications of metribuzin when crop is established as described under postemergence application of metribuzin. • Do NOT exceed total maximum rate of metribuzin recommended for your soil type. • Cool, wet weather may delay establishment, but yield is not usually affected. • For Eastern black nightshade, use the higher rate of DUAL II MAGNUM. • Preharvest interval is 60 days.
TREFLAN EC (480 g/L) or RIVAL EC (500 g/L) or BONANZA 400 (400 g/L) plus SENCOR 480 F (480 g/L)	1.2–2.4 L/ha 1.2–2.3 L/ha 1.5–2.75 L/ha 0.5–1.4 L/ha	0.48–0.96 L/ac 0.48–0.92 L/ac 0.6–1.1 L/ac 0.2–0.56 L/ac	
trifluralin plus metribuzin	0.6–1.15 kg/ha 0.25–0.7 kg/ha		

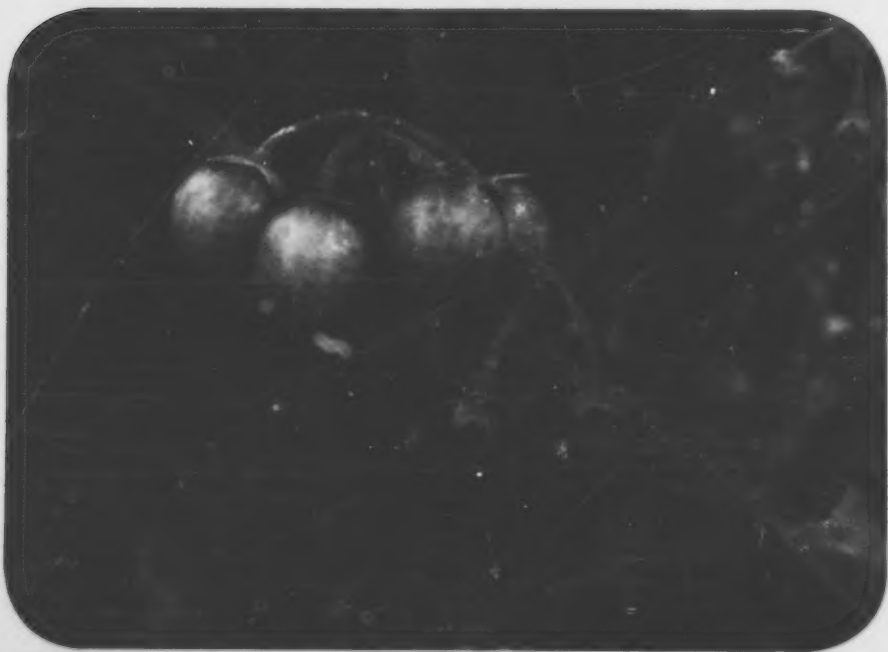
TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Postemergence Grass Herbicides			
EXCEL SUPER (80.5 g/L) fenoxaprop-p-ethyl	0.67 L/ha 0.054 kg/ha	0.27 L/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply POST when annual grasses are in the 1–6 leaf stage and volunteer corn is up to 25 cm tall. • Annual grasses emerging after application will not be controlled. • Do NOT apply other herbicides within 4 days of EXCEL SUPER application. • Do NOT apply by air. • Do NOT use flood jet nozzles or controlled droplet application equipment. • Spray tips angled forward 45° will give better coverage. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 55 days.
POAST ULTRA (450 g/L) plus MERGE sethoxydim surfactant/solvent	0.32–1.1 L/ha 1–2 L/ha 0.15–0.5 kg/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• Apply POST to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Do NOT apply any other chemicals within 4 days of POAST ULTRA application. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Preharvest interval is 60 days.
VENTURE L (125 g/L) fluzifop-p-butyl	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Apply in a maximum volume of 300 L/ha (120 L/ac). • Do NOT cultivate for 5 days after application. • Do NOT apply other herbicides within 3 days of VENTURE L application. • Do NOT apply if rain is expected within 2 hours after application. • Preharvest interval is 60 days.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergent Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
PINNACLE (75% DF) plus AGRAL 90	5.5–8.0 g/ha 2 L/1,000 L water	2.2–3.2 g/ac 2 L/1,000 L water	• Apply 3 weeks after transplanting to weeds less than 10 cm tall. • Add PINNACLE to the spray tank and agitate, then add AGRAL 90. • Do NOT apply in less than 100 L water/ha. • Do NOT apply if rain is expected within several hours. • Apply ONLY once per year. • Do NOT apply to tomatoes that are stressed. • Do NOT apply within 45 days of harvest.
thifensulfuron methyl plus non-ionic surfactant	4.125–6.0 g/ha 0.2% v/v		
Postemergent Grass and Broadleaf Herbicides			
PRISM (25DF) plus AGRAL 90 or AG-SURF	60 g/ha 2 L/1,000 L water	24 g/ac 2 L/1,000 L water	• Apply POST when hairy nightshade is up to the 4 leaf stage, quackgrass is in the 3–6 leaf stage (less than 10 cm tall), annual grasses are in the 1–6 leaf stage and redroot pigweed is at the 4–6 leaf stage. • Apply ONLY once per year. • Do NOT apply if rainfall is expected within 2 hours of application. • Preharvest interval is 30 days. • May be used on processing and fresh market tomatoes.
rimsulfuron plus non-ionic surfactant	15 g/ha 0.2% v/v		
SENCOR DF (75 DF) metribuzin	0.375–1.1 kg/ha 0.28–0.85 kg/ha	0.15–0.44 kg/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply POST at least 3 weeks after transplanting before weeds exceed 4 cm in height. • Apply ONLY once per season. • Direct spray to bottom one-third of tomato plants to reduce risk of crop injury. • Do NOT apply when crop is under stress due to cool, wet, cloudy weather or excessively hot temperatures. • Do NOT use on muck soils. • Do NOT use on soils with less than 2% organic matter. • Use lower rates on sandy soils, higher rates on clay soils. • Preharvest interval is 60 days.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
SENCOR 480 F (480 g/L)	0.3 L/ha	0.12 L/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply up to 4 POST applications per season. • Apply before the weeds are 2.5 cm in height. • BRAVO 500 fungicide (chlorothalanil) may be tank-mixed with this treatment at 2.4–4.8 L/ha (1.2–2.4 kg/ha active). Control of annual grasses may be reduced. • Do NOT apply when crop is under stress due to cool, wet, cloudy weather or excessively hot temperatures. • Do NOT use on muck soils. • Do NOT use on soils with less than 2% organic matter. • Do NOT exceed the maximum total rate of metribuzin recommended for your soil. • Preharvest interval is 30 days.
metribuzin	0.15 kg/ha		

Postemergent Tank-Mix Options

PRISM (25DF)	60 g/ha	24 g/ac	• Use ONLY on transplant tomatoes grown for processing. • Apply POST when hairy nightshade is up to the 4 leaf stage, quackgrass is in the 3–6 leaf stage (less than 10 cm tall), annual grasses are in the 1–6 leaf stage and redroot pigweed is at the 4–6 leaf stage. • Apply 3 weeks after transplanting to weeds less than 10 cm tall. • Do NOT apply in less than 200 L water/ha. • Do NOT apply if rain is expected within 2 hours of application. • Do NOT apply to tomatoes that are stressed. • Do NOT apply within 45 days of harvest.
plus PINNACLE (75% DF)	5.5–8.0 g/ha	2.2–3.2 g/ac	
plus AGRAL 90	2 L/1,000 L water	2 L/1,000 L water	
rimsulfuron	15 g/ha		
plus thifensulfuron methyl	4.125–6.0 g/ha		
plus non-ionic surfactant	0.2% v/v		



14. BERRY CROPS

In April of 2009, the Ministry of Environment amended the *Pesticides Act* with the *Cosmetic Pesticides Ban Act, 2008* and Ontario Regulation 63/09. Pesticides are now classified for sale and use under 11 different classes. It should be noted that agriculture (e.g. nursery production) is exempted. For more information on the legislation see the Ministry of the Environment's website at www.ontario.ca/pesticideban.

Cultural Weed Control in Berry Crops

A successful weed control program must integrate cultural and chemical weed control practices. Growers cannot depend entirely on chemical weed control in berry crops, since there is a limited spectrum of herbicides registered for these crops.

Perennial Weed Control

It is important to identify and control perennial weeds in the preplanting year. It is very difficult to control perennial weeds once a planting is established because of crop sensitivity to some herbicides and since it is not possible to clean cultivate in established berry crops.

The following perennial weeds present serious problems in these crops: quackgrass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground-ivy (creeping charlie) and burdock. In strawberries, sheep sorrel, toad flax and milkweed also present problems.

Systemic herbicides such as glyphosate (e.g. ROUND-UP) or amitrole (e.g. AMITROL 240) should be applied to perennial weeds in the preplanting year. Consult the product label and be sure to use the recommended

rate for the weed in question. Apply the herbicide at the proper stage of growth of the weed, otherwise only temporary control will be achieved. Repeated cultivation of some perennial weeds such as bindweed will also provide control.

Site Preparation

A green manure crop such as perennial ryegrass or Sudan grass should be established in the preplanting year following or in conjunction with measures to control perennial weeds. This crop will provide competition to reduce weed growth as well as improve the soil structure. Non-selective herbicides can be applied before planting the green manure crop and before plowing it under. Short residual selective herbicides such as 2,4-D may be used with the green manure crop, but avoid using herbicides that leave a soil residue that will carry over into the planting year. See Chapter 6, *Preplant-Site Preparation Prior To Any Crop*, page 81.

Mulching

For bramble and bush fruit, biodegradable plastic mulch could be used for weed control in the planting strip. Straw mulch will also assist in weed control beneath the plants or in the planting strip if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the plants. The mulch should be pulled away from around the plants for winter rodent protection.

For strawberries, use of straw mulch before weeds germinate can help control weeds. Some growers are trying plasticulture as a way to improve weed control.

Reducing Weed Pressure

Cultivation can provide weed control between the rows. In bramble and bush fruit, a vigorous sod between the rows will prevent weeds from becoming established. It is better to seed in a fescue sod rather than rely on a natural sod composed of weed and grass species, because the weeds will seed into the herbicide strip.

Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weeds that escape before they set seed, by cultural removal or chemical mowing. In some situations, tools such as a weed whip may be of use. Mowers are available which will cut close to the plants without injury. Mowing, however, will not eliminate weed competition.

Rotating Herbicide Families

(See Table 4-6, *Herbicide Groupings for Ontario*, page 65).

In perennial crops, rotation of herbicide families is important to minimize the build up of seed from weed escapes, including triazine tolerant weeds. Rotation will also help avoid an accumulation of herbicide residues in the soil that may result in crop injury over a period of years and may hinder replanting.

Herbicide Application Timings

Preplant (PP) Treatments

Preplant treatments are applied before the berry field is planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be

thoroughly incorporated into the soil by cultivation soon after application. Check the label. Also see *Preplant Weed Control, Preplant Site Preparation Prior To Any Crop* on page 81 for details of products, rates and remarks.

Preplant (PP) Weed and Cover Crop Control

Control cover crops and emerged weeds before planting berry crops. Refer to Table 6-1. *Non-Selective Herbicides Available for Preplant Site Preparation*, page 77. Alternatively, a grower may choose to kill the cover crop and/or emerged weeds just before planting the berry crop and either till the area or leave the seedbed untilled.

Preplant Incorporated (PPI)

Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall. These materials prevent emergence of many weed seedlings without reducing crop stand. Apply immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Postemergence (POST)

These chemicals are applied after the berry crop is planted. Applied as directed, the weeds can be killed without injury to the crop. Leaf stage of the weeds is critical for good control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed

control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Inter-row Weeding

The herbicide is directed between the berry crop rows onto the emerged weeds. The herbicide is used as a rescue operation where other methods of weed control have failed. Use special low pressure (7–15 kPa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. See *Stale Seedbed and Inter-Row Weeding*, page 82.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate (ROUNDUP). Check product labels for use of this application technique with other herbicides.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 14-1. Strawberry Herbicide Weed Control Ratings

Trade Name	Annual Grasses						Annual Broadleaves								Perennial Weeds																					
	barnyard grass	crabgrass	fall panicum	foxtails	witch grass	volunteer grains	chickweed, common	groundsel	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	snapdragon, dwarf	violet, field (field pansy)	bindweeds	brome grass	chickweed, mouse-eared	daisy, ox-eye	dandelion	ground-ivy (creeping-charlie)	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sorrel, sheep	sow-thistle	thistle, Canada	toadflax, yellow	vetches				
Soil Applied Grass and Broadleaf Herbicides																																				
BONANZA, TREFLAN, RIVAL	8	9	8	9	8	9	8	3	7	8	3	8	4	-	-	0	-	5	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0			
DACTHAL W-75	6	8	8	8	8	8	8	0	0	8	2	6	0	7	7	-	-	8	0	7	-	-	-	0	0	-	0	-	-	-	-	-	-			
DEVIRINOL	8	9	8	8	8	8	8	8	6	8	5	8	6	0	0	8 ^b	8	-	-	2	-	-	5	5	2	-	5	0	5	5	-	0				
DUAL II MAGNUM	9	9	9	9	9	-	-	-	2	7	2	7/8	4	-	-	0	-	-	-	5	-	-	0	8	5	-	4	-	0	0	-	0				
GOAL 2XL	5	5	5	5	5	5	-	8	8	9	9	9	8	-	9	-	-	-	5	-	-	-	-	-	-	-	-	5	5	5	-	-				
SINBAR	8	7	8	8	8	8	8 ^a	5	7 ^a	8 ^a	8 ^a	7 ^a	7 ^a	2	5 ^b	-	8	-	2	5	-	-	6	6	8	-	6	8	5	6	2	2				
Postemergence Grass Herbicide																																				
POAST + MERGE	9	8	9	9	9	9	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0				
VENTURE L	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0				
Postemergence Broadleaf Herbicide																																				
AIM EC (Hooded Sprayer Application)	-	-	-	-	-	-	-	8	-	8	8	8	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-				
2,4-D*	0	0	0	0	0	0	2	2	4	8	9	7	8	2	2	2	0	2	2	8	2	0	0	0	8	-	0	8	6	8	-	5				
LONTREL 360	0	0	0	0	0	0	0	8	-	5	-	5	9	-	-	0	0	0	8	8	0	0	0	0	0	0	0	9	8 ^c	9	0	9				
Postemergence Grass and Broadleaf Herbicide																																				
GRAMOXONE	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b	8 ^b				
GLYPHOSATE* ¹	9	9	9	9	9	9	9	8	9	8	9	9	8	-	-	7/8	9	9	-	8	5	5	9	8	9	9	8	8	9	9	8	5 ^a				

¹ Spot treatment only.

- Insufficient information available to make a rating.

* Various products are available, see Table 4-1. *Herbicides Used in Ontario*, page 23.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

^a Low rates and single applications may provide less control.

^b Top growth only; regrowth can be expected. Repeated treatments may provide control.

^c Seeding bindweed control only. This product will not control established bindweeds.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE*

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

BLUEBERRIES, HIGHBUSH

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

CULTURAL WEED CONTROL – see *Cultural Weed Control in Berry Crops*, page 249.

Mulching: Biodegradable mulch could be used for weed control within the plant row. Sawdust mulch will assist in weed control if it is applied early in the season before the weed seeds germinate. Apply sawdust 5 cm thick. The mulch will not prevent the germination of weed seeds that may blow onto the surface of the mulch.

In subsequent years, the organic matter in the mulch may tie up and thus reduce the effectiveness of certain residual herbicides.

The nitrogen requirements of the crop will change as the mulch is degraded. Initially nitrogen will be consumed by micro-organisms, thus necessitating higher rates of nitrogen fertilizer. Later, as the sawdust is degrading, nitrogen will be released and the crop may require less nitrogen fertilizer than an unmulched crop. It may take 2 years or more for sawdust mulch to significantly decompose. Adjust fertilizer rates according to mulch breakdown, plant growth and leaf nutrient analysis results.

Recommended rates per hectare or per acre refer to area actually treated with herbicide.

CAUTION – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of the planting.

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	175–225 kg/ha	70–90 kg/ac	• Established plantings ONLY. • PRE – Apply to cool moist but unfrozen soil in late fall or spring before weeds emerge. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • Use the lower rate if irrigation or rain will follow application. • 70 g CASORON G-4 applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/ac). • Use ONLY under plants established for at least 3 years. • Do NOT use on light, sandy soil.
dichlobenil	7–9 kg/ha		
CHATEAU WDG (51.1%)	0.28–0.42 kg/ha	0.11–0.16 kg/ac	• Established plantings ONLY. • Maximum 2 applications per growing season at least 30 days apart. • DO NOT apply to blueberries established for less than 2 years. • DO NOT apply after budbreak unless using hooded or shielded equipment. • Apply prior to weed emergence. • Apply lower rate on sandy (coarse textured) soils with less than 5% organic matter and the higher rate on clay (medium textured) with less than 5% organic matter. • Apply using ground application ONLY. • DO NOT apply through irrigation equipment.
flumioxazin	0.14–0.21 kg/ha		
DEVRINOL DF (50 DF)	9 kg/ha	3.6 kg/ac	• New and established plantings. • PRE – Apply once per season, either in the fall or spring, before weeds emerge. • Incorporation by rainfall or irrigation is essential. • Do NOT apply to frozen ground. • Do NOT apply within 70 days of harvest.
napropamide	4.5 kg/ha		
PRINCEP NINE-T (90 WG) or SIMAZINE 80W (80 WP)	2.5–3.75 kg/ha 2.75–4.25 kg/ha	1–1.5 kg/ac 1.1–1.7 kg/ac	• Established plantings ONLY. • PRE – Apply in 300–1,000 L/ha water (120–400 L/ac) before weed emergence. • Use lower rates for coarse, sandy soil. • Use higher rates for clay or higher organic matter soil. • Use only on established plants.
simazine	2.25–3.38 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SENCOR 75 DF (75WG)	1 kg/ha	0.4 kg/ac	• New plantings ONLY. • Apply as a directed application in a band under the bushes. • Apply to weed-free soil after planting. • Do NOT harvest blueberries for 2 years.
metribuzin	0.75 kg/ha		
SINBAR (80 WP)	2.75–4.25 kg/ha	1.1–1.7 kg/ac	• Established plantings ONLY. • PRE – Apply in 200–1,000 L/ha water (80–400 L/ac). • Use only in plantings established in the field for at least one year. • Make one application per year. • Injury may occur on sandy soil even with the low rate. • Use the high rate only on muck or peat soils where experience has shown this to be a safe practice.
terbacil	2.2–3.4 kg/ha		
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• New and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Do NOT apply closer than 15 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• New and established plantings. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. • Do NOT apply closer than 30 days to harvest.
fluzazifop-p-butyl	0.075–0.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows or between the plastic mulch. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season. • AIM EC may cause crop injury if the spray is allowed to come in contact with the green stem, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		• Established plantings ONLY. • For top growth control of yellow nut sedge. • Make 2 applications 7–10 days apart, when weeds are small. • Do NOT apply more than 2 times per year. • Do NOT apply closer than 25 days to harvest.
BASAGRAN ASSIST	1.75 L/ha 5 L/1,000 L	0.7 L/ac 5 L/1,000 L	• Established plantings ONLY. • For top growth control of yellow nut sedge. • Make 2 applications 7–10 days apart, when weeds are small. • Do NOT apply more than 2 times per year. • Do NOT apply closer than 25 days to harvest.
bentazon plus oil concentrate	0.84 kg/ha 0.5% v/v		
LONTREL 360 (360 g/L) clopyralid	0.42–0.83 L/ha 0.15–0.3 kg/ha	0.17–0.33 L/ac	• New and established plantings. • Apply once per year, directed under the bushes on emerged weeds. • For emerged vetch, use 0.42 L/ha. • For red and white clover, use 0.83 L/ha. • Do NOT apply closer than 45 days to harvest.
Non-Selective Herbicides and Tank Mix Options			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.8–5.6 L/ha 2.08–4.17 L/ha 2.0–4.0 L/ha 1.85–3.7 L/ha	1.12–2.24 L/ac 0.83–1.67 L/ac 0.8–1.6 L/ac 0.74–1.48 L/ac	• New and established plantings. • Apply as a directed spray under the bushes, avoiding new shoots. • Apply in 200–300 L/ha water (80–120 L/ac), using no more than 275 kPa pressure. • Avoid contact with fruit, foliage or canes. • Use only one application per season. • Do NOT apply closer than 30 days to harvest.
glyphosate	1–2 kg/ha		
GRAMOXONE (200 g/L) paraquat	5.5 L/ha 1.1 kg/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,000 L/ha water (400 L/ac). • For spot spraying, apply 55 mL product/10 L water sprayed to wet weed foliage. • Use on plantings established at least one year.
GRAMOXONE (200 g/L) plus PRINCEP NINE-T (90 WG) paraquat plus simazine	5 L/ha 2–2.5 kg/ha 1 kg/ha 1.8–2.25 kg/ha	2 L/ac 0.8–1 kg/ac	• Established plantings ONLY. • For emerged weeds with residual control of germinating weeds. • Apply as a directed spray to established plantings. • Use 1,000 L/ha water (400 L/ac) to wet weed foliage. • Use lower rates for coarse, sandy soil. • Use higher rates for clay or higher organic matter soil.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

CRANBERRIES

Maintaining a healthy and vigorous crop will aid in weed control by avoiding openings in the bed for weed germination and establishment.

Prevent weeds from setting seed on dikes and in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from setting seed. Seeding the dikes with a desirable grass cover will reduce the opportunities for weed establishment and will provide bank stabilization.

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	110 kg/ha	44 kg/ac
dichlobenil	4.4 kg/ha	

- **Established plantings ONLY.**
- PRE – For annual broadleaf weeds, certain sedges and *Juncus* species.
- Apply in early spring prebloom.
- Temporary reddening of plants may occur, especially with late spring applications.
- **Do NOT** use on new plantings, or on newly sanded beds.
- **Do NOT** use on beds recently mowed for vines.

DEVIRINOL 10G (10%)	45–67 kg/ha	18–26.8 kg/ac
napropamide	4.5–6.7 kg/ha	

- **Established plantings ONLY.**
- PRE – Apply once per year in spring and irrigate immediately.
- **Do NOT** use on new beds.

Postemergence Grass Herbicides

POAST ULTRA (450 g/L)	0.32–1.1 L/ha	0.13–0.45 L/ac
MERGE	1–2 L/ha	0.4–0.8 L/ac
sethoxydim	0.15–0.5 kg/ha	
plus surfactant/solvent	1–2 L/ha	

- **New and established plantings.**
- Apply to actively growing grasses.
- For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum).
- For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum).
- For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Use the high rate of MERGE for quackgrass.
- Use 100–200 L water/ha (40–80 L water/ac).
- Grasses emerging after application will not be controlled.
- Spray tips angled forward 45° will give better coverage.
- **Do NOT** use flood jet or hollow cone nozzles.
- **Do NOT** apply if rain is expected within one hour after application.
- **Do NOT** apply closer than 15 days to harvest.

VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac
fluzifop-p-butyl	0.075–0.25 kg/ha	

- **New and established non-bearing plantings.**
- Apply POST to actively growing grasses before tillering.
- Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn.
- Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley.
- Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails).
- Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence.
- **Use ONLY** one application per season.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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Postemergence Broadleaf Herbicides

2,4-D (470 g/L)*	1 L/2 L water		• New and established plantings. • For emerged annual and perennial weeds, including hardhack, St. John's Wort, alder and purple aster. • Apply with a ropewick or other wiper to actively growing weeds (June to July). • Do NOT contact the crop. • Use ONLY one application per year. • Do NOT apply closer than 50 days to harvest.
or 2,4-D (564 g/L)*	0.83 L/2 L water		
or 2,4-D (660 g/L)*	0.71 L/2 L water		
2,4-D*	0.47 kg/2 L water		
LONTREL 360 (360 g/L)	20 mL/L water (2% solution)		
clopyralid	7.2 g/L water		• New and established plantings. • For emerged vetch. • Do NOT use more than 2 applications a year – in spring before bud break, again until growth is 1–2 mm long, and/or in the fall at least 2 weeks after harvest, when vines have winter dormancy colour. • Apply with wiper equipment onto weed foliage that extends above the cranberry canopy. Avoid contact with cranberry shoots after growth begins. • Do NOT apply closer than 60 days to harvest.

Non-Selective Herbicide

glyphosate (360 g/L)*	1 L/4 L of water		• New and established plantings. • Apply with a rope wick or other similar device when weeds are 15 cm above the crop. • Avoid contact with the cranberry vines. • Do NOT apply when weeds are wet. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9.
or glyphosate (480 g/L)*	0.75 L/4 L of water		
or glyphosate (500 g/L)*	0.72 L/4 L of water		
or glyphosate (540 g/L)*	0.67 L/4 L of water		
glyphosate*	0.36 kg/4 L of water		

CURRENTS AND GOOSEBERRIES

Cultural Weed Control – See notes on *Cultural Weed Control in Berry Crops*, page 249. There are no herbicides registered for preemergence weed control in currants and gooseberries. A biodegradable mulch could be used for weed control in the planting strip. A straw mulch will assist in weed control.

Recommended rates per hectare or per acre refer to area actually treated with herbicide.

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Non-Selective Herbicide

GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,000 L/ha water (400 L/ac). • For spot treatment, apply 55 mL in 10 L of water, sprayed to wet weed foliage. • Direct spray to wet the weeds but avoid wetting the leaves or green bark of the bushes.
paraquat	1.1 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

RASPBERRIES

Cultural Weed Control – See notes on Cultural Weed Control in Berry Crops, page 249.

Site Preparation Before Planting – See Chapter 6, Preplant Weed Control, page 81.

Recommended rates per hectare or per acre refer to area actually treated with herbicide.

CAUTION: Simazine and DEVRINOL residues, high enough to harm many crops, may persist for several years after removal of a planting.

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	175 kg/ha	70 kg/ac	• Established plantings ONLY. • PRE – Apply on established raspberry plantings in late fall. • Apply to cool moist but unfrozen soil before weeds emerge. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • 70 g CASORON G-4 applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/ac). • Do NOT use on light, sandy soil. • Do NOT cultivate or work into the soil. • Do NOT apply in the spring as injury may result.
dichlobenil	7 kg/ha		
DEVRINOL DF (50 DF)	9 L/ha	3.6 L/ac	• New and established plantings. • PRE – Apply ONLY once per season, either in the fall or spring, before weeds emerge. • Incorporation by rainfall or irrigation is essential. • Do NOT apply to frozen ground. • Avoid contact with fruit or foliage.
napropamide	4.5 kg/ha		
PRINCEP NINE-T (90 WG)	2–2.5 kg/ha	0.8–1 kg/ac	• Established plantings ONLY. • PRE – Apply in 300–1,000 L/ha water (120–400 L/ac) before weed emergence. • Apply as a directed spray early in the spring before the weeds emerge. • Use lower rates for coarse, sandy soil. • Use higher rates for clay or higher organic matter soil. • Keep spray off young shoots. • Do NOT use in first year plantings.
or SIMADDEX (500 g/L)	3.6–4.5 L/ha	1.44–1.8 L/ac	
or SIMAZINE 480 (480 g/L)	3.8–4.7 L/ha	1.52–1.88 L/ac	
simazine	1.8–2.25 kg/ha		

Postemergence Grass Herbicides

POAST ULTRA (450 g/L)	0.32–1.1 L/ha	0.13–0.45 L/ac	• Established plantings ONLY. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Do NOT apply closer than 37 days to harvest.
plus MERGE	1–2 L/ha	0.4–0.8 L/ac	
sethoxydim	0.15–0.5 kg/ha		
plus surfactant/solvent	1–2 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
VENTURE L (125 g/L) fluzifop-p-butyl	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• New and established plantings. • Apply POST in early spring at prebloom stage to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. • Do NOT apply closer than 30 days to harvest.
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)* 2,4-D*	1.2 L/ha 0.98 L/ha 0.83 L/ha 0.55 kg/ha	0.48 L/ac 0.39 L/ac 0.33 L/ac	• New and established plantings. • Use the amine formulation. • Apply in 100–200 L/ha water (40–80 L/ac). • Do NOT spray when plants are in bloom. • Keep spray off new shoots as much as possible. • Spot spraying at a rate equivalent to 1 kg ai/ha (0.4 kg ai/ac) may be necessary to control established dandelions and other broadleaf weeds.
Non-Selective Herbicides and Tank Mix Options			
GRAMOXONE (200 g/L) paraquat	5.5 L/ha 1.1 kg/ha	2.2 L/ac	• New and established plantings. • Apply in 1,000 L/ha water (400 L/ac). • For spot spraying, apply 55mL GRAMOXONE/10 L water sprayed to wet weed foliage. • Direct spray at base of canes in the spring before new shoots emerge.
GRAMOXONE (200 g/L) plus PRINCEP NINE-T (90 WG) paraquat plus simazine	5 L/ha 2–2.5 kg/ha 1 kg/ha 1.8–2.25 kg/ha	2 L/ac 0.8–1 kg/ac	• Established plantings ONLY. • For emerged weeds with residual control of germinating weeds. • Apply as a directed spray to established plantings. • Do NOT spray young raspberry shoots. • Use 1,000 L/ha water (400 L/ac) to wet weed foliage. • Use lower rates for coarse, sandy soil. • Use higher rates for clay or higher organic matter soil.
IGNITE (150 g/L) glufosinate ammonium	6.67 L/ha 1 kg/ha	2.7 L/ac	• Established plantings ONLY. • For use in the production year of raspberries grown in the biennial production system, or in a planting that will be removed after harvest. • Do NOT apply to immature and weak plantings. • Apply when shoots are 10–20 cm tall to suppress the emerged flush of primocanes, and control any weeds emerged at time of treatment. • Apply in a minimum of 330 L water/ha (132 L/ac). • Avoid drift onto green tissue of floricanes.

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23
and Chapter 5, *Notes on Adjuvants*, page 69).

STRAWBERRIES

Cultural Weed Control – See notes on *Cultural Weed Control in Berry Crops*, page 249.

Use straw mulch that is free of weed seeds to avoid importing weeds into the field. The mulch should be spread between the rows when it is pulled off the plants in the spring to provide additional weed control.

Recommended rates per hectare or per acre refer to area actually treated with herbicide.

CAUTION: DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of a planting.

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Soil Applied Grass and Broadleaf Herbicides

CHATEAU WDG (51.1%)	0.21 kg/ha	0.08 kg/ac	• Planting year, 2–6 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Planting year, late fall. • Harvesting year, spring after mulch removal. • Harvesting year, renovation. • Harvesting year, late summer/fall (around Labour Day). • Planting year, late fall. • Apply once per season as a broadcast spray to dormant plants or as a row middle spray using a shielded sprayer to non-dormant plants • Apply prior to weed emergence. • Apply to coarse and medium textured soils with less than 5% organic matter. • Apply using ground application ONLY. • DO NOT apply after fruit set. • DO NOT allow spray drift to come in contact with fruit or foliage.
flumioxazin	0.11 kg/ha		
DACTHAL W-75	13.5 kg/ha	5.4 kg/ac	• Planting year, 2–4 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Harvesting year, spring after mulch removal. • PRE – before weed emergence. • Shallow cultivation to incorporate herbicide into the soil surface may improve weed control. • Do NOT use on muck soils.
chlorthal dimethyl	10.125 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
DEVIRINOL DF (50 DF) napropamide	9 kg/ha 4.5 kg/ha	3.6 kg/ac	• Planting year, 2–4 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Planting year, late fall. • Harvesting year, spring after mulch removal. • Harvesting year, late summer/fall (around Labour Day). • Harvesting year, late fall. • PRE. Apply once per season before weeds emerge or following cultivation. • Incorporation by rainfall, irrigation or cultivation is essential. • Where daughter plant establishment is important, (e.g. for plant producers) delay application until the desired number of daughter plants have been established. • Inhibition of daughter plant roots can occur where soil moisture is low and will be minimized if irrigation is applied shortly after application.
DUAL II MAGNUM (915 g/L) s-metolachlor/benoxacor	1.25–1.75 L/ha 1.14–1.6 kg/ha	0.5–0.7 L/ac	• Planting year, before planting. • PPI or PRE. Apply and incorporate, or apply post-transplanting before weeds emerge. • Apply ONLY once per year. • Apply by ground application equipment ONLY. • Do NOT apply to cultivar Joliette. • Do NOT harvest berries from varieties bearing fruit in year of planting.
GOAL 2XL (240 g/L) oxyfluorfen	1.0 L/ha 0.24 kg/ha	0.4 L/ac	• Planting year, late fall. • Harvesting year, late fall. • PRE – before weed emergence. • Apply in 500 L water/ha. • Apply ONLY once per year as a ground application. • Apply to dormant plants before applying mulch in late fall. • For control of labeled weeds plus field pansy and wood sorrel (oxalis). • DO NOT apply within 150 days of harvest.
SINBAR (80 WP) terbacil	0.7–0.85 kg/ha 0.56–0.68 kg/ha	0.28–0.34 kg/ac	• Planting year, late fall. • Harvesting year, renovation. • Harvesting year, late fall. • PRE – Apply to a weed-free soil surface just before mulching. • Apply in at least 300 L/ha water (120 L/ac). • Use low rate where it is planned to use SINBAR again in the spring. • Use lower rate on sandy soils low in organic matter. • Use lower rate on sensitive varieties such as Kent, Bounty, Micmac, Annapolis, Glooscap and Cavendish since they may be severely injured. • Do NOT apply to weak or diseased plants of any variety. • Do NOT overlap spray swaths.

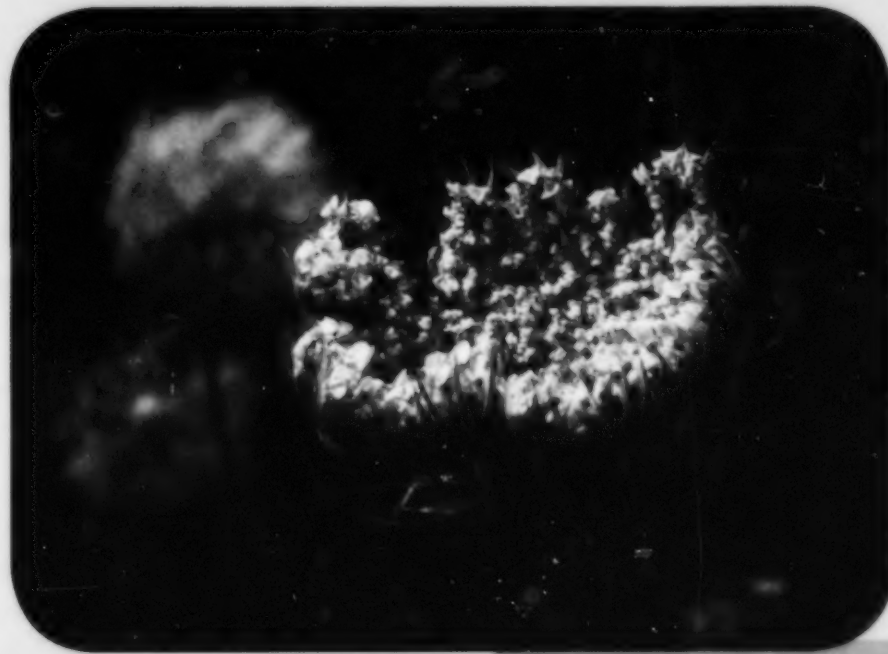
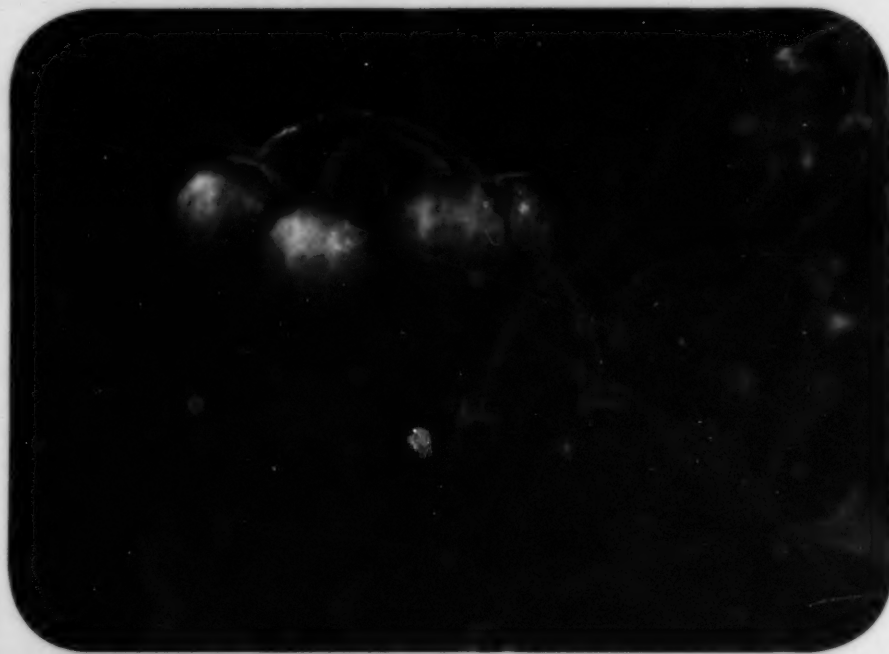
TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SINBAR (80 WP)	0.28–0.55 kg/ha	0.11–0.22 kg/ac	• Planting year, 4–6 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Harvesting year, spring after mulch removal. • Harvesting year, late summer/fall (around Labour Day). • PRE – Apply before weeds emerge or to very small weeds. • Apply when mother plants are well established but before runnering becomes extensive and new runner plants are rooting. • Apply in at least 300 L/ha water (120 L/ac). • Use lower rate on sandy soils low in organic matter. • Use lower rate on sensitive varieties such as Kent, Bounty, Micmac, Annapolis, Glooscap and Cavendish since they may be severely injured. • Do NOT apply to weak or diseased plants of any variety. • Do NOT overlap spray swaths. • Shallow cultivation can be done to train runners and control escaped weeds without destroying the effectiveness of SINBAR.
terbacil	0.22–0.44 kg/ha		
TREFLAN EC (480 g/L)	1.2–2.4 L/ha	0.48–0.96 L/ac	• Planting year ONLY. • PPI – Apply to weed-free soil and incorporate immediately in two directions. • May be applied and incorporated one day to 3 weeks before planting. • May delay establishment under stressful conditions.
or RIVAL EC (500 g/L)	1.2–2.2 L/ha	0.48–0.94 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
trifluralin	0.6–1.15 kg/ha		
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L)	0.32–1.1 L/ha	0.13–0.45 L/ac	• Planting year, 2–6 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Harvesting year, spring after mulch removal. • Harvesting year, renovation. • Harvesting year, late summer/fall (around Labour Day). • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. Use the high rate of MERGE for quackgrass. • Use 100–200 L water/ha (40–80 L water/ac). • Grasses emerging after application will not be controlled. • Spray tips angled forward 45° will give better coverage. • Do NOT use flood jet or hollow cone nozzles. • Do NOT apply if rain is expected within one hour after application. • Do NOT apply closer than 25 days to harvest. • Wait at least 14 days after application before applying SINBAR.
plus MERGE	1–2 L/ha	0.4–0.8 L/ac	
sethoxydim	0.15–0.5 kg/ha		
plus surfactant/solvent	1–2 L/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Planting year, 2–6 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Harvesting year, spring after mulch removal. • Harvesting year, renovation. • Harvesting year, late summer/fall (around Labour Day). • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. • Use only one application per season. • Wait at least 14 days after application before applying SINBAR.
fluzifop-p-butyl	0.075–0.25 kg/ha		
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	1.17 L/ha 0.98 L/ha 0.83 L/ha	0.47 L/ac	• Planting year, 2–6 weeks after planting. • Use the amine formulation. • Apply in 100–200 L/ha of water (40–80 L/ac). • Use low pressure and a coarse spray to minimize risk of spray drift to susceptible crops. • Do NOT use while early runners are rooting. • Do NOT use between mid-August and fall dormancy when flower buds are developing for next year's crop.
2,4-D*	0.55 kg/ha		
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2.2 L/ha 1.83 L/ha 1.57 L/ha	0.88 L/ac 0.73 L/ac 0.63 L/ac	• Harvesting year, renovation. • Apply after harvest but before mowing to control dandelions and other broadleaf perennials. Delay mowing for a few days after application. • Use amine formulation. • Do NOT apply 2,4-D between mid August and fall dormancy when strawberries are initiating flower buds. • Some cultivars like Veestar are more sensitive to 2,4-D than Redcoat.
2,4-D*	1.034 kg/ha		
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• Planting year, 2–4 weeks after planting. • Apply POST with a HOODED SPRAYER between the rows or between the plastic mulch. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 1 day to harvest. • Apply ONLY once per growing season. • AIM EC may cause crop injury if the spray is allowed to come in contact with the green stem, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
LONTREL 360 (360 g/L)	0.56–0.83 L/ha	0.22–0.33 L/ac	• Harvesting year ONLY, renovation. • To control tufted vetch, Canada thistle, sheep sorrel and ox-eye daisy. • Apply immediately after harvest at renovation, 7–10 days before mowing. • Apply with a boom sprayer in 150–250 L/ha of water (60–100 L/ac). • Apply once per year as a single treatment. • Early cultivars like Veestar or Annapolis may be more susceptible to injury. • Certain environmental stresses such as drought, flooding or severe overwintering conditions may increase the risk of injury. • Do NOT apply closer than 200 days to harvest.
clopyralid	0.2–0.3 kg/ha		
Non-Selective Herbicides			
glyphosate (360 g/L)	1 L/2 L water		• Planting year, 2–6 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Harvesting year, spring after mulch removal. • Harvesting year, renovation. • Harvesting year, late summer/fall (around Labour Day). • Apply with a rope wick or other similar device when weeds are 15 cm above the crop. • Avoid contact with the strawberry plants. • Do NOT apply when weeds are wet. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9.
or glyphosate (480 g/L)*	0.75 L/2 L of water		
or glyphosate (500 g/L)*	0.72 L/2 L of water		
or glyphosate (540 g/L)*	0.67 L/2 L of water		
glyphosate*	0.36 kg/2 L		
glyphosate (360 g/L)*	1–2 L/100 L water		• Planting year, 2–6 weeks after planting. • Planting year, late summer/fall (around Labour Day). • Harvesting year, spring after mulch removal. • Harvesting year, renovation. • Harvesting year, late summer/fall (around Labour Day). • Use hand held sprayers as a spot treatment if wiper equipment is not available. • Avoid contact with strawberry plant: crop in the treated area will be killed. • Do NOT apply closer than 30 days before harvest.
or glyphosate (480 g/L)*	0.75–1.5 L/100 L water		
or glyphosate (500 g/L)*	0.72–1.44 L/100 L water		
or glyphosate (540 g/L)*	0.67–1.34 L/100 L water		
glyphosate*	0.36–0.72 kg/100 L		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Planting year, late summer/fall (around Labour Day). • Harvesting year, renovation. • Harvesting year, late summer/fall (around Labour Day). • Apply to remove weeds between narrow strawberry rows. • Apply in 550–1,100 L/ha water (220–440 L/ac). • Apply on a calm day. • Use shields with low pressure and a spray nozzle arrangement to avoid drift. • Complete coverage is important. Use higher water volumes on dense vegetation. • Perennial weeds will only be suppressed. • Only emerged weeds will be controlled.
paraquat	1.1 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.





15. TREE FRUIT & GRAPES

In April of 2009, the Ministry of Environment amended the *Pesticides Act* with the *Cosmetic Pesticides Ban Act, 2008* and Ontario Regulation 63/09. Pesticides are now classified for sale and use under 11 different classes. It should be noted that agriculture (e.g. nursery production) is exempted. For more information on the legislation see the Ministry of the Environment's website at www.ontario.ca/pesticideban.

Cultural Weed Control in Fruit Crops

A successful weed control program must integrate cultural and chemical weed control practices. Growers cannot depend entirely on chemical weed control in fruit and vine crops, since there is a limited spectrum of herbicides registered for these crops.

Perennial Weed Control

It is important to identify and control perennial weeds in the preplanting year. It is very difficult to control perennial weeds once a planting is established because of crop sensitivity to some herbicides and since it is not possible to clean cultivate in established orchards or vineyards.

The following perennial weeds present serious problems in these crops; quackgrass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground-ivy (creeping charlie) and burdock.

Systemic herbicides such as glyphosate (e.g. ROUNDUP) or amitrole (e.g. AMITROL 240) should be applied to perennial weeds in the preplanting year. Consult the product label and be sure to use the recommended

rate for the weed in question. Apply the herbicide at the proper stage of growth of the weed, otherwise only temporary control will be achieved. Repeated cultivations of some perennial weeds such as bindweed will also provide control.

Site Preparation

A green manure crop such as perennial rye-grass or Sudan grass should be established in the preplanting year following or in conjunction with measures to control perennial weeds. This crop will provide competition to reduce weed growth as well as improving the soil structure. Non-selective herbicides can be applied before planting the green manure crop and before plowing it under. Short residual selective herbicides such as 2,4-D may be used with the green manure crop, but avoid using herbicides that leave a soil residue that will carry over into the planting year. See Chapter 6, *Preplant-Site Preparation Prior To Any Crop*, page 81.

Mulching

A biodegradable plastic mulch could be used for weed control in the planting strip. Mulch will also assist in weed control beneath the trees or in the planting strip if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the plants. The mulch should be pulled away from around the tree bases for winter rodent protection. Peastone gravel is another option that can be applied around the base of the trees. The gravel will provide weed control, as well as, improve drainage, encourage deeper rooting and discourage rodents.

Reducing Weed Pressure

Cultivation can provide weed control between the rows. Alternatively, a vigorous sod between the rows will prevent weeds from becoming established. It is better to seed a fescue sod rather than rely on a natural sod composed of weed and grass species because the weeds will seed into the orchard or vine row.

Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weeds that escape before they set seed by cultural removal or chemical mowing. In some situations, tools such as a weed whip may be of use. Mowers are available which will cut close to the trees without injury. Mowing, however, will not eliminate weed competition.

Rotating Herbicide Families

(See Table 4-6. *Herbicide Groupings for Ontario*, page 65).

In perennial crops, rotation of herbicide families is important to minimize the build up of seed from weed escapes, including triazine tolerant weeds. Rotation will also help avoid an accumulation of herbicide residues in the soil that may result in crop injury over a period of years and may hinder replanting.

Herbicide Application Timings

Preplant (PP) Treatments

Preplant treatments are applied before the orchard or vineyard is planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must

be thoroughly incorporated into the soil by cultivation soon after application. Check the label. Also see *Preplant Weed Control, Preplant Site Preparation Prior To Any Crop* on page 81 for details of products, rates and remarks.

Preplant (PP) Weed and Cover Crop Control

Control cover crops and emerged weeds before planting orchards or vineyards. Refer to Table 6-1. *Non-Selective Herbicides Available for Preplant Site Preparation*, page 77. Alternatively, a grower may choose to kill the cover crop and/or emerged weeds just before planting the orchard or vine crop and either till the area or leave the seedbed untilled.

Preplant Incorporated (PPI)

Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness and/or treating fields with perennial weeds last.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall. These materials prevent emergence of many weed seedlings without reducing crop stand. Apply immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Postemergence (POST)

These chemicals are applied after the orchard or vineyard is planted. Applied as directed, the weeds can be killed without injury to the crop. Leaf stage of the weeds is critical for good weed control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to recommended leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or

other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Inter-row Weeding

The herbicide is directed between the orchard and/or vineyard rows onto the emerged weeds. The herbicide is used as a rescue operation where other methods of weed control have failed. Use special low pressure (7–15 kPa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. See *Stale Seedbed and Inter-Row Weeding*, page 82.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate (ROUNDUP). Check product labels for use of this application technique with other herbicides.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g. too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 15-1. Fruit Crop Weed Control Ratings

Trade Name	Crop Registrations									Annual Grasses					Annual Broadleaves					Perennial Weeds																						
	apples	apricots	blackberries	cherries/plums	currants/gooseberries	grapes	highbush blueberries	peaches	pears	raspberries	barnyard grass	crabgrass	fall panicum	foxtails	witch grass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper		
Soil Applied Grass Herbicides																																										
DUAL II MAGNUM	✓	✓	✓					✓			9	9	8	9	9	-	6	2	7	2	8	4	0	-	5	-	-	-	-	0	-	8	5	-	0	0	0	0	0	0	0	0
FRONTIER						✓					9	9	8	9	9	4	-	2	7	2	8	4	0	-	-	-	-	-	-	0	-	8	-	-	0	0	0	0	0	0	0	
Soil Applied Grass and Broadleaf Herbicides																																										
CASORON	✓		✓	✓		✓	✓	✓	✓	✓	7	6	6	6	7	-	8	7	8	3	8	4	7	7	7	-	5	6	-	-	-	7	7	5	7	7	-	7	7	-		
DEVRIKOL	✓		✓				✓	✓	✓	✓	8	9	8	8	8	8	7	6	8	5	8	7	-	-	5	-	-	-	-	5	-	5	5	1	5	5	-	5	1	-		
KARMEX						✓					9	5	5	5	8	-	9	9	9	9	8	9	-	-	5	-	-	-	-	5	-	5	-	-	5	5	-	5	-			
KERB	✓							✓			8	7	8	8	9	8	9	7	9	8	9	7	-	-	-	-	-	-	6	-	6	-	-	6	6	-	-	-	-			
LEXONE	✓	✓		✓ ¹				✓	✓		8	8	9	9	9	-	9	9	9	9	8	8	-	8	6	2	2	2	2	6	2	6	8	2	6	2	2	6	2	0		
LOROX	✓			✓				✓			7	6	5	8	9	-	9	7	9	7	8	8	5	8	-	-	-	-	5	-	8	-	-	7	8	-	7	-	-			
PRINCEP NINE-T, SIMADEX, SIMAZINE 480	✓	✓	✓			✓	✓	✓	✓	✓	8	8	6	8	8	-	8	9	9	9	9	8	2	-	5	-	-	-	0	-	5	-	-	6	5	-	5	0	-			
SENCOR	✓	✓		✓ ¹				✓			7	8	9	8	9	-	9	9	9	9	8	8	2	-	-	-	-	-	2	2	2	-	-	2	2	-	2	2	0			
SINBAR	✓	✓ ²		✓ ²			✓	✓	✓ ²		8	7	8	8	8	5	9	7	8	8	7	7	6	8	6	-	-	-	6	-	6	8	-	6	1	-	6	1	-			
TREFLAN	✓ ²	✓ ²		✓ ²			✓ ²	✓ ²			9	9	8	8	8	-	7	6	8	3	8	4	2	-	2	1	1	1	0	2	2	-	2	0	2	2	2	2	2	0		

* Various formulations available. See Table 4-1. *Herbicides Used in Ontario*, page 23. Not all formulations are registered on all crops. See label for specific uses and rates.

✓ Indicates crop registration.

^a Top growth only; regrowth can be expected.

^b Use higher rates when larger than 15 cm tall or across.

- Insufficient information available to make a rating.

¹ For cherries only.

² Non-bearing trees only.

³ For plums only.

⁴ Hooded sprayer application only.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TABLE 15-1. Fruit Crop Weed Control Ratings (cont'd)

Trade Name	Crop Registrations										Annual Grasses					Annual Broadleaves					Perennial Weeds																					
	apples	apricots	blackberries	cherries/plums	currants/gooseberries	grapes	highbush blueberries	peaches	pears	raspberries	barnyard grass	crabgrass	fall panicum	foxtails	witch grass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper		
Soil Applied Grass and Broadleaf Tank-Mixes																																										
DEVIRINOL + PRINCEP NINE-T	✓ ²	✓ ²		✓ ²				✓ ²	✓ ²		8	9	8	8	8	8	7	9	9	9	9	8	8	2	-	5	2	2	2	2	2	5	2	5	5	1	6	5	2	5	1	0
DEVIRINOL + SINBAR	✓ ²	✓ ²		✓ ²				✓ ²	✓ ²		8	9	8	8	8	8	9	7	8	8	8	7	6	-	6	2	2	2	2	2	6	2	6	8	1	6	5	2	6	1	0	
DUAL II MAGNUM + LEXONE	✓	✓		✓						✓	9	9	9	9	9	-	9	9	9	9	8	8	2	-	5	-	-	-	-	-	2	2	8	-	-	2	2	2	2	2	0	
DUAL II MAGNUM + PRINCEP NINE-T	✓	✓		✓						✓	9	9	9	9	9	-	9	9	9	9	8	8	2	-	5	-	-	-	-	0	-	8	-	-	6	5	-	5	0	-		
SENCOR + TREFLAN	✓ ²	✓ ²		✓ ²				✓ ²	✓ ²		8	8	9	9	9	-	9	9	9	9	8	8	2	-	2	1	1	1	0	2	2	2	2	0	2	2	2	2	2	2	0	
Postemergence Grass Herbicides																																										
POAST ULTRA	✓	✓		✓				✓	✓	✓	8	8	9	8	9	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
VENTURE L	✓	✓		✓				✓	✓	✓	9	9	9	9	9	-	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0
Postemergence Broadleaf Herbicides																																										
AIM EC (Hooded Sprayer)	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	✓ ⁴	-	-	-	-	-	-	-	-	8	8	8	-	-	-	-	-	-	-	8	-	8	-	-	-	-	-	-	-	-	-		
BASAGRAN	✓ ²	✓ ²		✓ ²				✓ ²	✓ ²		0	0	0	0	0	0	8	9	7	8	8	8	7	-	-	-	-	-	-	5	2	8 ^a	2	-	2	5	8 ^a	6	5	-	-	
2,4-D*	✓	✓		✓				✓	✓	✓	0	0	0	0	0	-	7	4	8	9	9	8	5	2	8	2	5	2	2	2	-	2	8	-	2	6	-	8	5	-	-	
Postemergence Grass and Broadleaf Herbicides																																										
AMITROL-240	✓										-	-	8	-	-	-	7	6	6	-	5	-	-	-	9	-	2	-	-	8	-	8	-	8	8	8	6	8	8	-	-	
GLYPHOSATE*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	9	9	9	9	-	9	9	9	9	9	9	8	9	8/9 ^a	-	8	5	5	9	-	5	9	9	9	9	5	9	5 ^a	8 ^a	-	
GRAMOXONE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	9	9	9	9	-	9	9	9	9	9	9	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	
GRAMOXONE + DEVIRINOL	✓						✓		✓		9	9	9	9	9	-	9	9	9	9	9	9	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a
IGNITE	✓		✓ ³				✓		✓		9	9	9	9	9	-	9	9	9	8	9	9	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	8 ^a	5	9	8 ^a	8 ^a	8 ^a	8 ^a

* Various formulations available. See Table 4-1. Herbicides Used in Ontario, page 23. Not all formulations are registered on all crops. See label for specific uses and rates.

✓ Indicates crop registration.

^a Top growth only; regrowth can be expected.

^b Use higher rates when larger than 15 cm tall or across.

- Insufficient information available to make a rating.

¹ For cherries only.

² Non-bearing trees only.

³ For plums only.

⁴ Hooded sprayer application only.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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APPLES

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Recommended rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

CAUTION – Simazine, DEVRINOL and SINBAR residues high enough to harm many crops may persist for several years after removal of orchard.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.75 L/ha	0.7 L/ac	• New and established plantings. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
<i>s-metolachlor/benoxacor</i>	1.6 kg/ha		
KERB (50 WSP)	4.5 kg/ha	1.8 kg/ac	• Established plantings ONLY. • PRE – Apply from late September to early November when soil is cool and moist but not frozen. • Use ONLY under apple trees established at least one year. • 4.5 kg/ha is equivalent to 45 g/100 m².
<i>propyzamide</i>	2.25 kg/ha		

Soil Applied Broadleaf Herbicide

LEXONE DF (75DF)	1 kg/ha	0.4 kg/ac	• Established plantings ONLY. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with tree trunks and leaves.
<i>metribuzin</i>	0.75 kg/ha		

Soil Applied Grass and Broadleaf Herbicides

AMITROL 240 (231 g/L)	9.5–13.5 L/ha	3.8–5.4 L/ac	• Established plantings ONLY. • For all emerged weeds including poison ivy. • Spray to wet entire weed to the ground after foliage has fully developed. • Keep spray off tree trunks as much as possible. • Do NOT apply closer than 30 days before harvest.
<i>amitrole</i>	2.25–3.25 kg/ha		
CASORON G-4 (4 Gr)	110–175 kg/ha	44–70 kg/ac	• Established plantings ONLY. • PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • Do NOT apply until 4 weeks after transplanting. • Do NOT use on light sandy soils. • 70 g of CASORON G-4 applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/ac).
<i>dichlobenil</i>	4.4–7 kg/ha		
CHATEAU WDG (51.1%)	0.28–0.42 kg/ha	0.11–0.16 kg/ac	• Established plantings ONLY. • Maximum 2 applications per growing season at least 30 days apart. • Do NOT apply within 100 m of non-dormant pears. • Apply using ground application ONLY. • Do NOT apply to trees established less than one year. • Do NOT apply after bud break unless using hooded or shielded equipment.
<i>flumioxazin</i>	0.14–0.21 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
DEVIRINOL DF (50 DF)	9 kg/ha	3.6 kg/ac	• New and established plantings. • PRE – Apply in the fall through early spring before weeds emerge, but not on frozen ground. • Avoid contact with fruit and foliage. • Use a directed spray at low pressure. • Incorporation by rainfall or irrigation is essential within 2 days of application. • Do NOT apply when fruit is on the ground during harvest.
napropamide	4.5 kg/ha		
DEVIRINOL DF (50 DF) plus PRINCEP NINE-T (90 WG)	7 kg/ha 2.25 kg/ha	2.8 kg/ac 0.9 kg/ac	• Make ONLY one application in the planting year. • Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Do NOT apply on frozen ground or during harvest. • Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide plus simazine	3.5 kg/ha 2.025 kg/ha		
DEVIRINOL DF (50 DF) plus SINBAR (80 WP)	9 kg/ha 0.6 kg/ha	3.6 kg/ac 0.24 kg/ac	• Make ONLY one application in the planting year. • Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Do NOT apply on frozen ground or during harvest. • Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide plus terbacil	4.5 kg/ha 0.48 kg/ha		
DUAL II MAGNUM (915 g/L) plus PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha 1.1–2.5 kg/ha	0.5–0.7 L/ac 0.44–0.88 kg/ac	• New and established plantings • PRE – Apply post-planting, once per year as a band treatment before weeds emerge, preferably after rain has settled the soil around the trees. • Do NOT use on sandy soils with less than 2% organic matter. • Avoid contact with tree trunks and leaves. • For established plantings use higher rates.
s-metolachlor/benoxacor plus simazine	1.14–1.6 kg/ha 0.99–2.25 kg/ha		
DUAL II MAGNUM (915 g/L) plus LEXONE DF (75 DF)	1.75 L/ha 1 kg/ha	0.7 L/ac 0.4 kg/ac	• Established plantings ONLY. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
s-metolachlor/benoxacor plus metribuzin	1.6 kg/ha 0.75 kg/ha		
LEXONE DF (75DF)	0.5–1 kg/ha	0.2–0.4 kg/ac	• Planting year ONLY. • PPI before planting trees. • Make a single application as an orchard floor or planting row treatment.
metribuzin	0.38–0.75 kg/ha		
LOROX DF (50 DF)	9 kg/ha	3.6 kg/ac	• Established plantings ONLY. • PRE – Apply as directed spray before weeds are 10 cm high. • Apply in 400–600 L/ha water (160–240 L/ac). • Add a surfactant. • Avoid contact with fruit, foliage or tree bark with spray or drift. • Use ONLY under trees established at least 10 years.
linuron	4.5 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
PRINCEP NINE-T (90 WG) simazine	1.1–2.2 kg/ha 1–2 kg/ha	0.44–0.88 kg/ac	• Planting year. • PRE – Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees. • Apply once per season. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soils with less than 2% organic matter.
PRINCEP NINE-T (90 WG) or SIMADEX (500 g/L) or SIMAZINE 480 (480 g/L) simazine	2.5–5 kg/ha 4.5–9 L/ha 4.7–9.4 L/ha 2.25–4.5 kg/ha	1–2 kg/ac 1.8–3.6 L/ac 1.88–3.76 L/ac	• Established plantings ONLY. • PRE – Apply in 300–1,000 L/ha water (120–400 L/ac). • Use only under trees planted for one year or more. • Use higher rate on perennial weeds such as quackgrass. • May be combined with glyphosate.
SENCOR 75 DF (75 WG) plus TREFLAN EC(480 g/L) or BONANZA 400 (400 g/L) metribuzin plus trifluralin	0.55–0.75 kg/ha 1.25–2.4 L/ha 1.5–2.75 L/ha 0.42–0.56 kg/ha 0.6–1.15 kg/ha	0.22–0.3 kg/ac 0.5–0.96 L/ac 0.6–1.1 L/ac	• Make ONLY one application in the planting year. • Planting year ONLY. • PPI before planting trees as an orchard floor or planting row treatment.
SINBAR (80 WP) terbacil	1.25 kg/ha 1 kg/ha	0.5 kg/ac	• Planting year. • PRE – Apply after planting trees, before weeds emerge. • Do NOT use on soils with less than 3% organic matter. • Avoid contact with tree trunks and leaves.
SINBAR (80 WP) terbacil	2.25–4.5 kg/ha 1.8–3.6 kg/ha	0.9–1.8 kg/ac	• Established plantings. • PRE – Apply in 1,000 L/ha water (400 L/ac). • Use only under trees established for at least 3 years.
SINBAR (80 WP) plus LEXONE DF (75DF) terbacil plus metribuzin	0.63 kg/ha 1 kg/ha 0.5 kg/ha 0.75 kg/ha	0.25 kg/ac 0.4 kg/ac	• Established plantings. • PRE – Apply as a band under trees before weeds emerge. • Use only one application per year. • Do NOT use on soil coarser than sandy loam with less than 3% organic matter.
TREFLAN EC (480 g/L) or BONANZA 400 (400 g/L) trifluralin	1.2–2.4 L/ha 1.5–2.75 L/ha 0.6–1.15 kg/ha	0.48–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • PPI – Apply and incorporate before planting trees. • Apply once in the planting year ONLY. • Use at least 100 L/ha water (40 L/ac).
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L) plus MERGE sethoxydim plus surfactant/solvent	0.32–1.1 L/ha 1–2 L/ha 0.15–0.5 kg/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• New and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. • Do NOT apply closer than 25 days to harvest.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
VENTURE L (125 g/L) <i>fluzifop-p-butyl</i>	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• New and established plantings. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Do NOT apply more than once per year. • Grasses emerging after the treatment will not be controlled.
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2 L/ha 1.68 L/ha 1.44 L/ha	0.8 L/ac 0.67 L/ac 0.58 L/ac	• Established plantings ONLY. • For broadleaf weeds, including dandelion, seedling Canada thistle and sow thistle. • Apply in early spring after weeds emerge or postharvest to actively growing weeds. • Do NOT apply when usable fruit is on the orchard floor. • Do NOT apply closer than 80 days to harvest.
2,4-D*	0.95 kg/ha		
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season. • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
BASAGRAN (480 g/L) ASSIST	1.75–2.25 L/ha 1–2 L/ha	0.7–0.9 L/ac 0.4–0.8 L/ac	• New and established plantings. • Directed spray only. Do not overspray. • Apply in 100–400 L/ha water (40–160 L/ac) with at least 275 kPa pressure. • Avoid tree leaves. • Use lower rate of ASSIST under hot, humid conditions. • Make ONLY two applications, 10 days apart at the low rate, in the planting year.
bentazon plus oil concentrate	0.84–1.08 kg/ha 1–2 L/ha		
LONTREL 360 (360 g/L) <i>clopyralid</i>	0.56 L/ha 0.202 kg/ha	0.22 L/ac	• New and established plantings. • For control of vetch at early flowering stage. • Apply in the spring as a spot treatment. • Avoid contact with tree limbs. • Do NOT apply when usable fruit is on the orchard floor. • Do NOT apply closer than 30 days to harvest.

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Non-Selective Herbicides and Tank Mix Options			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha	0.9–4.8 L/ac 0.68–3.6 L/ac 0.65–3.5 L/ac 0.6–3.2 L/ac	• Established plantings ONLY. • For actively growing weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Remove all suckers from base of trunks before application. • Do NOT apply to trees with “green” bark in the area of application. • Do NOT mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • Do NOT apply closer than 30 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-3. <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
glyphosate*	0.81–4.32 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1 L/2 L water 0.75 L/2 L water 0.72 L/2 L water 0.67 L/2 L water		
glyphosate*	0.36 kg/2 L		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1–2 L/100 L water 0.75–1.5 L/100 L water 0.72–1.44 L/100 L water 0.67–1.34 L/100 L water		
glyphosate*	0.36–0.72 kg/100 L		• Established plantings ONLY. • Use hand held sprayers as a spot treatment if wiper equipment is not available. • Avoid contact with leaves, trunks and suckers. • Do NOT apply closer than 30 days before harvest.
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,100 L/ha (440 L/ac) water. • For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit. • May be used in mixtures with SINBAR, DEVRINOL or simazine.
paraquat	1.1 kg/ha		
GRAMOXONE (200 g/L) plus DEVRINOL DF (50 DF)	5.5 L/ha 9 kg/ha	2.2 L/ac 3.6 kg/ac	• Established plantings ONLY. • Add DEVRINOL to tank first then agitate and add GRAMOXONE. • Apply in 1,100 L/ha water (440 L/ac). • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit.
paraquat	1.1 kg/ha		
plus napropamide	4.5 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
GRAMOXONE (200 g/L) plus PRINCEP NINE-T (90 WG)	5 L/ha 2–2.5 kg/ha	2 L/ac 0.8–1 kg/ac	• Established plantings ONLY. • To control emerged weeds and provide residual control of germinating weeds. • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit. • See Precautions on GRAMOXONE and PRINCEP above.
paraquat plus simazine	1 kg/ha 1.8–2.25 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Established plantings ONLY. • Apply as a directed spray before weeds are 30 cm high. • Use 110–330 L/ha water (44–132 L/ac). • Where weed growth is heavy, use the higher rate and larger water volume. • Do NOT apply closer than 40 days to harvest. • For trees established at least one year.
glufosinate ammonium	0.405–0.75 kg/ha		
IGNITE (150 g/L) plus PRINCEP NINE-T (90 WG) or SIMADDEX (500 g/L)	2.7–5 L/ha 2–5 kg/ha 4.5–9 L/ha	1.08–2 L/ac 0.8–2 kg/ac 1.8–3.6 L/ac	• Established plantings ONLY. • To control emerged weeds plus residual control of annual grasses and broadleaf weeds. • Use as a directed spray around the bases of trees established at least one year. • Do NOT apply closer than 40 days to harvest.
glufosinate ammonium plus simazine	0.405–0.75 kg/ha 2.25–4.5 kg/ha		
PRINCEP NINE-T (90 WG) plus glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–5 kg/ha 2.25–12 L/ha 1.67–8.9 L/ha 1.6–8.54 L/ha 1.48–7.9 L/ha	0.9–2 kg/ac 0.9–4.8 L/ac 0.67–3.56 L/ac 0.64–3.41 L/ac 0.59–3.16 L/ac	• Established plantings ONLY. • To control actively growing weeds, with residual control of germinating weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Remove all suckers from base of trunks before application. • Do NOT apply to trees with “green” bark in the area of application.
simazine plus glyphosate	2–4.5 kg/ha 0.8–4.27 kg/ha		

APRICOTS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Recommended rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

CAUTION – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.75 L/ha	0.7 L/ac	• New and established plantings. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
s-metolachlor/benoxacor	1.6 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Soil Applied Broadleaf Herbicide			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
Soil Applied Grass and Broadleaf Herbicides			
CHATEAU WDG (51.1%) flumioxazin	0.28–0.42 kg/ha 0.14–0.21 kg/ha	0.11–0.16 kg/ac	• Established plantings ONLY. • Maximum 2 applications per growing season at least 30 days apart. • DO NOT apply within 100 m of non-dormant pears. • Apply using ground application ONLY. • DO NOT apply to trees established less than 2 years. • DO NOT apply during the period after flowering through leaf drop unless using hooded or shielded equipment.
DEVIRINOL DF (50 DF) plus PRINCEP NINE-T (90 WG) napropamide plus simazine	7 kg/ha 2.25 kg/ha 3.5 kg/ha 2 kg/ha	2.8 kg/ac 0.9 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Incorporation by rainfall or irrigation is essential. • Do NOT apply on frozen ground. • Make ONLY one application in the year of planting.
DEVIRINOL DF (50 DF) plus SINBAR (80 WP) napropamide plus terbacil	9 kg/ha 0.6 kg/ha 4.5 kg/ha 0.48 kg/ha	3.6 kg/ac 0.24 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Incorporation by rainfall or irrigation is essential. • Do NOT apply on frozen ground. • Make ONLY one application in the year of planting.
DUAL II MAGNUM (915 g/L) plus LEXONE DF (75 DF) s-metolachlor/benoxacor plus metribuzin	1.75 L/ha 1 kg/ha 1.6 kg/ha 0.75 kg/ha	0.7 L/ac 0.4 kg/ac	• Established plantings ONLY. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
DUAL II MAGNUM (915 g/L) plus PRINCEP NINE-T (90 WG) s-metolachlor/benoxacor plus simazine	1.25–1.75 L/ha 1.1–2.5 kg/ha 1.14–1.6 kg/ha 1–2.25 kg/ha	0.5–0.7 L/ac 0.44–1 kg/ac	• New and established plantings. • PRE – Apply after planting, before weeds emerge, preferably after rain has settled the soil around the trees. • Apply once in the year of planting. • Do NOT use on sandy soils with less than 2% organic matter. • Avoid contact with tree trunks and leaves. • Apply high rate on established plantings.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
LEXONE DF (75 DF)	0.5–1 kg/ha	0.2–0.4 kg/ac	• New and established plantings. • PPI – Apply before planting trees in the year of planting. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with tree trunks and leaves.
<i>metribuzin</i>	0.38–0.75 kg/ha		
PRINCEP NINE-T (90 WG)	1.1–2.2 kg/ha	0.44–0.88 kg/ac	• Planting year ONLY. • PRE – Apply after planting, before weeds emerge, preferably after rain has settled the soil around the trees. • Apply ONLY once per season. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soils with less than 2% organic matter.
<i>simazine</i>	1–2 kg/ha		
SENCOR 75 DF (75 WG) plus TREFLAN EC (480 g/L) or BONANZA 400 (400 g/L)	0.55–0.75 kg/ha 1.25–2.4 L/ha 1.5–2.75 L/ha	0.22–0.3 kg/ac 0.5–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • PPI – Apply and incorporate before planting trees. • Apply as an orchard floor or planting row treatment. • Apply ONCE in the year of planting only.
<i>metribuzin</i> <i>plus trifluralin</i>	0.42–0.56 kg/ha 0.6–1.15 kg/ha		
SINBAR (80 WP) plus LEXONE DF (75DF)	0.63 kg/ha 1 kg/ha	0.25 kg/ac 0.4 kg/ac	• Established plantings ONLY. • PRE – Apply as a band under trees before weeds emerge. • Use only one application per year. • Do NOT use on soil coarser than sandy loam with less than 3% organic matter.
<i>terbacil</i> <i>plus metribuzin</i>	0.5 kg/ha 0.75 kg/ha		
TREFLAN EC (480 g/L) or BONANZA 400 (400 g/L)	1.25–2.4 L/ha 1.5–2.75 L/ha	0.5–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • PPI – Apply and incorporate before planting trees. • Use at least 100 L/ha water (40 L/ac). • Apply ONLY once in the planting year.
<i>trifluralin</i>	0.6–1.15 kg/ha		
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L) MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• New and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. • Do NOT apply closer than 30 days to harvest.
<i>sethoxydim</i> <i>plus surfactant/solvent</i>	0.15–0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Established plantings ONLY. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • ONLY apply once per year. • Grasses emerging after the treatment will not be controlled.
<i>fluzifop-p-butyl</i>	0.075–0.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2 L/ha 1.68 L/ha 1.44 L/ha	0.8 L/ac 0.67 L/ac 0.58 L/ac	• Established plantings ONLY. • For broadleaf weeds, including dandelion, seedling Canada thistle and sow thistle. • Apply in early spring after weeds emerge or postharvest to actively growing weeds. • Do NOT apply when usable fruit is on the orchard floor. • Do NOT apply closer than 80 days to harvest.
2,4-D*	0.95 kg/ha		
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season. • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
BASAGRAN (480 g/L) plus MERGE	1.75–2.25 L/ha 1–2 L/ha	0.7–0.9 L/ac 0.4–0.8 L/ac	• Planting year ONLY. • Directed spray only. Do not overspray. • Apply in 100–400 L/ha water (40–160 L/ac) with at least 275 kPa pressure. • Use lower rate of MERGE under hot, humid conditions. • Make ONLY 2 applications, 10 days apart at 1.75 L/ha (0.7 L/ac) in the planting year.
bentazon plus surfactant/solvent	0.84–1.08 kg/ha 1–2 L/ha		
Non-Selective Herbicides			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha	0.9–4.8 L/ac 0.68–3.6 L/ac 0.65–3.5 L/ac 0.6–3.2 L/ac	• Established plantings ONLY. • For actively growing weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Remove all suckers from base of trunks before application. • Do NOT apply to trees with "green" bark in the area of application. • Do NOT mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • Do NOT apply closer than 30 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-3, <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
glyphosate*	0.81–4.32 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1 L/2 L water 0.75 L/2 L water 0.72 L/2 L water 0.67 L/2 L water		• Established plantings ONLY. • Apply with a rope wick or other similar device when weeds are at the optimum stage. • Avoid contact with the leaves, trucks and suckers. • Do NOT apply when weeds are wet. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9. • Do NOT apply closer than 30 days to harvest.
glyphosate*	0.36 kg/2 L		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1–2 L/100 L water 0.75–1.5 L/100 L water 0.72–1.44 L/100 L water 0.67–1.34 L/100 L water		• Established plantings ONLY. • Use hand held sprayers as a spot treatment if wiper equipment is not available. • Avoid contact with leaves, trucks and suckers. • Do NOT apply closer than 30 days before harvest.
glyphosate*	0.36–0.72 kg/100 L		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,100 L/ha (440 L/ac) water. • For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. • Use in orchards established one year or more. • Avoid contact with green bark, leaves or fruit.
paraquat	1.1 kg/ha		

CHERRIES AND PLUMS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Recommended rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

CAUTION – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.

Soil Applied Grass Herbicides

DUAL II MAGNUM (915 g/L)	1.75 L/ha	0.7 L/ac	• New and established plantings. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
s-metolachlor/benoxacor	1.6 kg/ha		

Soil Applied Broadleaf Herbicides

LEXONE DF (75DF)	1 kg/ha	0.4 kg/ac	• Established plantings ONLY. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with tree trunks and leaves.
metribuzin	0.75 kg/ha		

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	110–175 kg/ha	44–70 kg/ac	• Established plantings. • PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • Do NOT apply until 4 weeks after transplanting. • Do NOT use on light sandy soils. • 70 g of CASORON G-4 applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/ac).
dichlobenil	4.4–7 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
CHATEAU WDG (51.1%) <i>flumioxazin</i>	0.28–0.42 kg/ha 0.14–0.21 kg/ha	0.11–0.16 kg/ac	• Established plantings ONLY. • Maximum 2 applications per growing season at least 30 days apart. • Do NOT apply within 100 m of non-dormant pears. • Apply using ground application ONLY. • Do NOT apply to trees established less than 2 years. • Do NOT apply during the period after flowering through leaf drop unless using hooded or shielded equipment.
DEVIRINOL DF (50 DF) plus PRINCEP NINE-T (90 WG) <i>napropamide</i> <i>plus simazine</i>	7 kg/ha 2.25 kg/ha 3.5 kg/ha 2 kg/ha	2.8 kg/ac 0.9 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Incorporation by rainfall or irrigation is essential. • Do NOT apply on frozen ground. • Make ONLY one application in the planting year.
DEVIRINOL DF (50 DF) plus SINBAR (80 WP) <i>napropamide</i> <i>plus terbacil</i>	9 kg/ha 0.6 kg/ha 4.5 kg/ha 0.48 kg/ha	3.6 kg/ac 0.24 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Incorporation by rainfall or irrigation is essential. • Do NOT apply on frozen ground. • Make ONLY one application in the planting year.
DUAL II MAGNUM (915 g/L) plus LEXONE DF (75 DF) <i>s-metolachlor/benoxacor</i> <i>plus metribuzin</i>	1.75 L/ha 1 kg/ha 1.6 kg/ha 0.75 kg/ha	0.7 L/ac 0.4 kg/ac	• Established plantings ONLY. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
DUAL II MAGNUM (915 g/L) plus PRINCEP NINE-T (90 WG) <i>s-metolachlor/benoxacor</i> <i>plus simazine</i>	1.25–1.75 L/ha 1.1–2.5 kg/ha 1.14–1.6 kg/ha 1–2.25 kg/ha	0.5–0.7 L/ac 0.44–1 kg/ac	• New and established plantings. • PRE – Apply after planting, before weeds emerge, preferably after rain has settled the soil around the trees. • Apply once in the year of planting. • Do NOT use on sandy soils with less than 2% organic matter. • Avoid contact with tree trunks and leaves. • Late season crabgrass and fall panicum may escape this treatment. • Use higher rate in established plantings.
LEXONE DF (75DF) <i>metribuzin</i>	0.5–1 kg/ha 0.38–0.75 kg/ha	0.2–0.4 kg/ac	• Planting year ONLY. • PPI – Apply in the year of planting only. • Registered on cherries only. • Make a single application as a broadcast treatment or within the planting row.
LOROX DF (50 DF) <i>linuron</i>	8.6 kg/ha 4.3 kg/ha	3.44 kg/ac	• Established plantings ONLY. • Use ONLY under trees established for 10 years. • PRE – Apply as a directed spray before weeds are 10 cm high. • Apply in 400–600 L/ha water (160–240 L/ac). • Add a surfactant. • Use ONLY under trees established for 10 years. • Keep spray off fruit, leaves and green bark of trees.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
SENCOR 75 DF (75 WG) plus TREFLAN EC (480 g/L) or BONANZA 400 (400 g/L)	0.55–0.75 kg/ha 1.2–2.4 L/ha 1.5–2.75 L/ha	0.22–0.3 kg/ac 0.48–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • Apply ONLY once in the year of planting. • PPI – Apply and incorporate before planting trees.
metribuzin plus trifluralin	0.42–0.56 kg/ha 0.6–1.15 kg/ha		
SINBAR (80 WP)	1.25 kg/ha	0.5 kg/ac	• Planting year. • PRE – Apply after planting trees, before weeds emerge. • Do NOT use on soils with less than 3% organic matter. • Avoid contact with tree trunks and leaves.
terbacil	1 kg/ha		
SINBAR (80 WP) plus LEXONE DF (75DF)	0.63 kg/ha 1 kg/ha	0.25 kg/ac 0.4 kg/ac	• Established plantings. • Apply ONLY once in the year of planting. • PRE – Apply as a band under trees before weeds emerge. • Registered on cherries only. • Do NOT use on soil coarser than sandy loam with less than 3% organic matter.
terbacil plus metribuzin	0.5 kg/ha 0.75 kg/ha		
TREFLAN EC (480 g/L) or BONANZA 400 (400 g/L)	1.2–2.4 L/ha 1.5–2.75 L/ha	0.48–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • Apply ONLY once in the year of planting. • PPI – Apply and incorporate before planting trees. • Use at least 100 L/ha water (40 L/ac).
trifluralin	0.6–1.15 kg/ha		
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• New and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. • Do NOT apply closer than 25 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Established plantings ONLY. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Apply ONLY once per year. • Grasses emerging after the treatment will not be controlled.
fluzafop-p-butyl	0.075–0.25 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2 L/ha 1.68 L/ha 1.44 L/ha	0.8 L/ac 0.67 L/ac 0.58 L/ac	• Established plantings. • For broadleaf weeds, including dandelion, seedling Canada thistle and sow thistle. • Apply in early spring after weeds emerge or postharvest to actively growing weeds. • Do NOT apply when usable fruit is on the orchard floor. • Do NOT apply closer than 80 days to harvest.
2,4-D*	0.95 kg/ha		
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
BASAGRAN (480 g/L) ASSIST	1.75–2.25 L/ha 1–2 L/ha	0.7–0.9 L/ac 0.4–0.8 L/ac	• Planting year ONLY. • Registered on cherries only. • Tolerant as a directed spray only. Do not overspray. • Avoid tree leaves. • Apply in 100–400 L/ha water (40–160 L/ac) with at least 275 kPa pressure. • Use lower rate of ASSIST under hot, humid conditions. • Make 2 applications, 10 days apart at 1.75 L/ha (0.7 L/ac) in the planting year.
bentazon plus oil concentrate	0.84–1.08 kg/ha 1–2 L/ha		
Non-Selective Herbicides			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha	0.9–4.8 L/ac 0.68–3.6 L/ac 0.65–3.5 L/ac 0.6–3.2 L/ac	• Established plantings ONLY. • For actively growing weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Remove all suckers from base of trunks before application. • Do NOT apply to trees with “green” bark in the area of application. • Do NOT mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • Do NOT apply closer than 30 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-3. <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
glyphosate*	0.81–4.32 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1 L/2 L water 0.75 L/2 L water 0.72 L/2 L water 0.67 L/2 L water		• Established plantings ONLY. • Apply with a rope wick or other similar device when weeds are at the optimum stage. • Avoid contact with the leaves, trucks and suckers. • Do NOT apply when weeds are wet. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9. • Do NOT apply closer than 30 days to harvest.
glyphosate*	0.36 kg/2 L		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1–2 L/100 L water 0.75–1.5 L/100 L water 0.72–1.44 L/100 L water 0.67–1.34 L/100 L water		• Established plantings ONLY. • Use hand held sprayers as a spot treatment if wiper equipment is not available. • Avoid contact with leaves, trucks and suckers. • Do NOT apply closer than 30 days before harvest.
glyphosate*	0.36–0.72 kg/100 L		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,000 L/ha water (400 L/ac). • For spot spraying, apply 55 mL in 10 L water sprayed to wet weed foliage. • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit. • May be tank-mixed with linuron for trees established at least 10 years.
paraquat	1.1 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Established plantings ONLY. • Registered on plums only. • Apply as a directed spray before weeds are 30 cm high. • Use 110–330 L/ha water (44–132 L/ac). • Where weed growth is heavy, use the higher rate and larger water volume. • Do NOT apply closer than 40 days to harvest. • For trees established at least one year.
glufosinate ammonium	0.405–0.75 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23
and Chapter 5, *Notes on Adjuvants*, page 69).

GRAPES

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Cultural Weed Control – See *Cultural Weed Control in Fruit Crops*, page 265.

Hilling the vines at regular intervals throughout the year will aid in weed control. Be aware that this disruption of the soil will also disturb any residual herbicides.

The use of cultivation, mulch or rye cover crops between the rows will provide better water penetration as well as aid in weed control.

Cultivation after planting is needed to level the soil, and early establishment on trellises or staked will minimize damage from cultivation. Hilling for winter protection can be started in late summer, and will control late germinating weeds. Removing of hills each spring will also aid in weed control.

Recommended rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

CAUTION – Simazine, KARMEX, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of vineyard.

Soil Applied Grass Herbicides

FRONTIER (900 g/L)	1.4 L/ha	0.56 L/ac	• Non-bearing grapevines ONLY. • Do NOT harvest within 2 years of application on first year grapes. • Do NOT harvest within one year of application on 2nd year grapes. • PRE – Rainfall is required within 10 days of application to achieve sufficient herbicide activation. • Do NOT apply by air. • Apply to weed-free soil, after planting or dehillling.
dimethenamid	1.26 kg/ha		
FRONTIER MAX (720 g/L)	0.96 L/ha	0.38 L/ac	• Non-bearing grapevines ONLY. • Do NOT harvest within 2 years of application on first year grapes. • Do NOT harvest within one year of application on 2nd year grapes. • PRE – Rainfall is required within 10 days of application to achieve sufficient herbicide activation. • Single application directed under the vines. • Do NOT apply by air. • Apply to weed-free soil, after planting or dehillling.
dimethenamid	0.69 kg/ha		

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	110–225 kg/ha	44–90 kg/ac	• Established plantings ONLY. • PRE – Apply to cool moist but unfrozen soil in late fall or spring before weeds emerge. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • Apply to dormant healthy vines ONLY. • Do NOT apply to vines until they have been established for at least 2 full years. • For annual weeds, use 110–175 kg/ha (44–70 kg/ac). • For quackgrass, and broadleaf perennial weeds, use 175–225 kg/ha (70–90 kg/ac).
dichlobenil	4.4–9 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
CHATEAU WDG (51.1%) flumioxazin	0.28–0.42 kg/ha 0.14–0.21 kg/ha	0.11–0.16 kg/ac	• Established plantings ONLY. • Do NOT apply to grapes established for less than 2 years. • Maximum 2 applications per growing season at least 30 days apart. • Do NOT apply within 100 m of non-dormant pears. • Apply using ground application ONLY. • Do NOT apply after bud break unless using hooded or shielded equipment.
KARMEX (80 DF) diuron	2.25–6.7 kg/ha 1.8–5.36 kg/ha	0.9–2.68 kg/ac	• Established plantings ONLY. • PRE – Apply as a directed spray to a 1 m strip under vines before weeds emerge. • Apply in at least 300 L/ha water (120 L/ac). • Use ONLY in vineyards established for at least 3 years. • On soils low in clay or organic matter (1–2%), use 2.25–3.25 kg/ha (of area actually sprayed); on soil high in clay or organic matter use 3.25–6.75 kg/ha. • Apply just prior to germination and growth of annual weeds, usually in the spring. • It may be desirable to make a fall treatment or divide applications equally between fall and spring treatment. Do not exceed the above rates per year as injury may result. • When a second application is performed, observe a minimum interval of 90 days between the first application and retreatment. • May be tank-mixed with GRAMOXONE.
PRINCEP NINE-T (90 WG) or SIMADDEX (500 g/L) or SIMAZINE 480 (480 g/L) simazine	4–5 kg/ha 7.2–9 L/ha 7.5–9.4 L/ha 3.6–4.5 kg/ha	1.6–2 kg/ac 2.9–3.6 L/ac 3–3.76 L/ac	• Established plantings ONLY. • PRE – Apply after hills are removed, but before weeds emerge. • Apply in at least 300 L/ha water (120 L/ac). • Use higher rates on perennial weeds. • Use ONLY in vineyards established for at least 3 years. • May be tank-mixed with IGNITE and glyphosate.
Postemergence Grass Herbicides			
VENTURE L (125 g/L) fluzifop-p-butyl	0.6–2 L/ha 0.075–0.25 kg/ha	0.24–0.8 L/ac	• New, 2nd year non-bearing grapevines and established plantings. • Apply POST to actively growing grasses before tillering. • Apply as banded application to the base of the grape vine. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Apply ONLY once per year. • Grasses emerging after the treatment will not be controlled.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Postemergence Broadleaf Herbicides			
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season. • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
Non-Selective Herbicides and Tank Mix Options			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha	0.9–4.8 L/ac 0.68–3.6 L/ac 0.65–3.5 L/ac 0.6–3.2 L/ac	• Established plantings ONLY. • For actively growing weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Do NOT use on vines less than 3 years old. • Direct spray to avoid leaves and green stems of grapevines. • Do NOT mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • Do NOT apply closer than 14 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-3. <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
glyphosate*	0.81–4.32 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1 L/2 L water 0.75 L/2 L water 0.72 L/2 L water 0.67 L/2 L water		• Established plantings ONLY. • Apply with a rope wick or other similar device when weeds are at the optimum stage. • Direct spray to avoid leaves and green stems of grapevines. • Apply when weeds are wet. • Do NOT use on vines less than 3 years old. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9. • Do NOT apply closer than 14 days to harvest.
glyphosate*	0.36 kg/2 L		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1–2 L/100 L water 0.75–1.5 L/100 L water 0.72–1.44 L/100 L water 0.67–1.34 L/100 L water		• Established plantings ONLY. • Use hand held sprayers as a spot treatment if wiper equipment is not available. • Direct spray to avoid leaves and green stems of grapevines. • Do NOT use on vines less than 3 years old. • Do NOT apply closer than 14 days before harvest.
glyphosate*	0.36–0.72 kg/100 L		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)* plus PRINCEP NINE-T (90 WG)	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha 2.5–5 kg/ha	0.9–4.8 L/ac 1–2 kg/ac	• Established plantings ONLY. • For vines established at least 3 years. • Use as a directed spray avoiding leaves, suckers and green bark on vines. • Use higher rates for perennial weeds and heavy weed infestations. • To control emerged weeds with residual control of germinating annual weeds. • See Precautions for IGNITE and simazine. • Do NOT use within 40 days of harvest.
glyphosate* plus simazine	0.81–4.32 kg/ha 2.25–4.5 kg/ha		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,100 L/ha (440 L/ac) water. • For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. • Use on vines established on trellises. • Avoid contact with green bark, leaves or fruit. • May be tank-mixed with KARMEX.
paraquat	1.1 kg/ha		
GRAMOXONE (200 g/L) plus TROPOTOX PLUS (400 g/L)	5.5 L/ha 2.75 L/ha	2.2 L/ac 1.1 L/ac	• Established plantings ONLY. • Apply in late May or early June, or when bindweed starts to bloom. • Apply in 1,000 L/ha water (400 L/ac) as a low pressure, coarse spray. • For spot spraying, with a shielded nozzle, apply 55 mL GRAMOXONE + 30 mL TROPOTOX PLUS/10 L water/100 m². • Use only when necessary as a spot treatment. TROPOTOX PLUS can injure grapes. • Direct spray to avoid contact with leaves and stems of grapevines.
paraquat	1.1 kg/ha		
plus MCPB/MCPA (15:1)	1.1 kg/ha		
GRAMOXONE (200 g/L) plus DEVRINOL DF (50 DF)	5.5 L/ha 9 kg/ha	2.2 L/ac 3.6 kg/ac	• Established plantings ONLY. • Add DEVRINOL to tank first, then agitate and add GRAMOXONE. • Apply in 1,100 L/ha water (440 L/ac).
paraquat	1.1 kg/ha		
plus napropamide	4.5 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Established plantings ONLY. • For vines established at least 3 years. • Apply as a directed spray before annual weeds are 30 cm high. • Avoid suckers and green bark. • Use 110–330 L/ha water (44–132 L/ac). • Where weed growth is heavy, use the higher rate and larger water volume. • Do NOT apply closer than 40 days to harvest.
glufosinate ammonium	0.405–0.75 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
IGNITE (150 g/L) plus PRINCEP NINE-T (90 WG) or SIMADDEX (500 g/L)	2.7–5 L/ha 4–5 kg/ha 7.2–9 L/ha	1.08–2 L/ac 1.6–2 kg/ac 2.88–3.6 L/ac	• Established plantings ONLY. • For vines established at least 3 years. • Use as a directed spray avoiding leaves, suckers and green bark on vines. • To control emerged weeds with residual control of germinating annual weeds. • See Precautions for IGNITE and simazine. • Do NOT harvest until 40 days after application.
glufosinate ammonium plus simazine	0.405–0.75 kg/ha 3.6–4.5 kg/ha		

PEACHES

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Recommended rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

CAUTION – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	110–175 kg/ha	44–70 kg/ac	• Established plantings ONLY. • PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • Do NOT apply until 4 weeks after transplanting. • Do NOT use on light sandy soils. • 70 g of CASORON G-4 applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/ac).
dichlobenil	4.4–7 kg/ha		
CHATEAU WDG (51.1%)	0.28–0.42 kg/ha	0.11–0.16 kg/ac	• Established plantings ONLY. • Maximum 2 applications per growing season at least 30 days apart. • Do NOT apply within 100 m of non-dormant pears. • Apply using ground application ONLY. • Do NOT apply to trees established less than 2 years. • Do NOT apply during the period after flowering through leaf drop unless using hooded or shielded equipment.
flumioxazin	0.14–0.21 kg/ha		
DEVRINOL 50W (50 WP)	9 kg/ha	3.6 kg/ac	• Established plantings ONLY. • PRE – Incorporation by rainfall or irrigation is essential. • Apply in the fall through early spring before weeds emerge, but not on frozen ground. • Avoid contact with fruit and foliage.
napropamide	4.5 kg/ha		
DEVRINOL DF (50 DF) PRINCEP NINE-T (90 WG)	7 kg/ha 2.25 kg/ha	2.8 kg/ac 0.9 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Do NOT apply on frozen ground or during harvest. • Make ONLY one application in the planting year. • Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide plus simazine	3.5 kg/ha 2 kg/ha		
DEVRINOL DF (50 DF) plus SINBAR (80 WP)	9 kg/ha 0.6 kg/ha	3.6 kg/ac 0.24 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Do NOT apply on frozen ground or during harvest. • Make ONLY one application in the planting year. • Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide plus terbacil	4.5 kg/ha 0.48 kg/ha		

TRADE NAME (Concentration). active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
DUAL II MAGNUM (915 g/L) <i>s-metolachlor/benoxacor</i>	1.75 L/ha 1.6 kg/ha	0.7 L/ac	• Established plantings. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
DUAL II MAGNUM (915 g/L) plus LEXONE DF (75 DF) <i>s-metolachlor/benoxacor</i> <i>plus metribuzin</i>	1.75 L/ha 1 kg/ha 1.6 kg/ha 0.75 kg/ha	0.7 L/ac 0.4 kg/ac	• Established plantings. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
DUAL II MAGNUM (915 g/L) plus PRINCEP NINE-T (90 WG) <i>s-metolachlor/benoxacor</i> <i>plus simazine</i>	1.25–1.75 L/ha 1.1–2.5 kg/ha 1.14–1.6 kg/ha 1–2.25 kg/ha	0.5–0.7 L/ac 0.44–1 kg/ac	• New and established plantings. • PRE – Apply post planting, before weeds emerge, preferably after rain has settled the soil around the trees. • Apply once in the year of planting. • Do NOT use on sandy soils with less than 2% organic matter. • Avoid contact with tree trunks and leaves. • Use high rate on established plantings.
LEXONE DF (75DF) <i>metribuzin</i>	0.5–1 kg/ha 0.38–0.75 kg/ha	0.2–0.4 kg/ac	• New and established plantings. • PPI – Apply and incorporate before planting trees. Make a single application as a broadcast treatment or within the planting row. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with tree trunks and leaves. • Used the higher rate on established plantings.
LOROX DF (50 DF) <i>linuron</i>	8.6 kg/ha 4.3 kg/ha	3.44 kg/ac	• Established plantings ONLY. • PRE – Apply in 400–600 L/ha water (160–240 L/ac) as a directed spray before weeds are 12 cm high. • Use only under peach trees established for over one year. • Avoid contact with fruit, foliage or tree bark with spray or drift. • Add a surfactant.
PRINCEP NINE-T (90 WG) <i>simazine</i>	1.1–2.2 kg/ha 1–2 kg/ha	0.44–0.88 kg/ac	• Planting year ONLY. • PRE – Apply post planting, before weeds emerge, preferably after rain has settled the soil around the trees. • Apply once in the year of planting. • Do NOT use on sandy soils with less than 2% organic matter. • Avoid contact with tree trunks and leaves.
SENCOR 75 DF (75 WG) plus TREFLAN EC 480 g/L or BONANZA 400 (400 g/L) <i>metribuzin</i> <i>plus trifluralin</i>	0.55–0.75 kg/ha 1.25–2.4 L/ha 1.5–2.75 L/ha 0.42–0.56 kg/ha 0.6–1.155 kg/ha	0.22–0.3 kg/ac 0.5–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • PRE – Apply and incorporate before planting trees. • Apply ONLY once in the year of planting. • Apply as a broadcast treatment or within the planting row.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
SINBAR (80 WP)	1.25 kg/ha	0.5 kg/ac	• Planting year. • PRE – Apply after planting trees, before weeds emerge. • Do NOT use on soils with less than 3% organic matter. • Avoid contact with tree trunks and leaves.
terbacil	1 kg/ha		
SINBAR (80 WP)	2.25–4.5 kg/ha	0.9–1.8 kg/ac	• Established plantings. • PRE – Apply in 1,000 L/ha of water (400 L/ac). • Use ONLY under trees established for at least 3 years. • Apply as a band under the trees before weeds emerge. • Do NOT use on soils with less than 3% organic matter.
terbacil	1.8–3.6 kg/ha		
SINBAR (80 WP) plus LEXONE DF (75DF)	0.63 kg/ha 1 kg/ha	0.25 kg/ac 0.4 kg/ac	• Established plantings. • PRE – Apply as a band under trees before weeds emerge. • Use ONLY one application per year. • Do NOT use on soil coarser than sandy loam with less than 3% organic matter.
terbacil plus metribuzin	0.5 kg/ha 0.75 kg/ha		
TREFLAN EC (480 g/L) BONANZA 400 (400 g/L)	1.25–2.4 L/ha 1.5–2.75 L/ha	0.5–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • PPI – Apply and incorporate before planting trees. • Use at least 100 L/ha water (40 L/ac). • Apply as a broadcast treatment or within the planting row. • Apply ONLY once in the year of planting.
trifluralin	0.6–1.15 kg/ha		
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• New and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. • Do NOT apply closer than 25 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L)	1 L–2 L/ha	0.4–0.8 L/ac	• Established plantings ONLY. • Apply to actively growing grasses. • For annual grasses, use 1 L/ha. Apply at the 2–6 leaf stage. • For quackgrass, use 2 L/ha. Apply at the 3–5 leaf stage. • Apply ONLY once per year. • Grasses emerging after the treatment will not be controlled.
fluzifop-p-butyl	0.125–0.25 kg/ha		
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2 L/ha 1.68 L/ha 1.44 L/ha	0.8 L/ac 0.67 L/ac 0.58 L/ac	• Established plantings ONLY. • For broadleaf weeds, including dandelion, seedling Canada thistle and sow thistle. • Apply in early spring after weeds emerge or postharvest to actively growing weeds. • Do NOT apply when usable fruit is on the orchard floor. • Do NOT apply closer than 80 days to harvest.
2,4-D*	0.95 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		
BASAGRAN (480 g/L) plus ASSIST	1.75–2.25 L/ha 1–2 L/ha	0.7–0.9 L/ac 0.4–0.8 L/ac	• Planting year ONLY. • Directed spray only. Do not overspray. • Avoid tree leaves. • Apply in 100–400 L/ha water (40–160 L/ac) with at least 275 kPa pressure. • Use lower rate of ASSIST under hot, humid conditions. • Make ONLY 2 applications, 10 days apart at 1.75 L/ha (0.7 L/ac) in the planting year.
bentazon plus oil concentrate	0.84–1.08 kg/ha 1–2 L/ha		
Non-Selective Herbicides and Tank Mix Options			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha	0.9–4.8 L/ac 0.68–3.6 L/ac 0.65–3.5 L/ac 0.6–3.2 L/ac	• Established plantings ONLY. • For actively growing weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Remove all suckers from base of trunks before application. • Do NOT apply to trees with “green” bark in the area of application. • Do NOT mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • Do NOT apply closer than 30 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-3, <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
glyphosate*	0.81–4.32 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1 L/2 L water 0.75 L/2 L water 0.72 L/2 L water 0.67 L/2 L water		• Established plantings ONLY. • Apply with a rope wick or other similar device when weeds are at the optimum stage. • Avoid contact with the leaves, trucks and suckers. • Do NOT apply when weeds are wet. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9. • Do NOT apply closer than 30 days to harvest.
glyphosate*	0.36 kg/2 L		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1–2 L/100 L water 0.75–1.5 L/100 L water 0.72–1.44 L/100 L water 0.67–1.34 L/100 L water		- Established plantings ONLY. - Use hand held sprayers as a spot treatment if wiper equipment is not available. - Avoid contact with leaves, trucks and suckers. - Do NOT apply closer than 30 days before harvest.
glyphosate*	0.36–0.72 kg/100 L		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	- Established plantings ONLY. - Apply in 1,100 L/ha (440 L/ac) water. - For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. - Use on trees established one year or more. - Avoid contact with green bark, leaves or fruit. - May be used in mixtures with DEVRINOL.
paraquat	1.1 kg/ha		
GRAMOXONE (200 g/L) plus DEVRINOL DF (50 DF)	5.5 L/ha 9 kg/ha	2.2 L/ac 3.6 kg/ac	- Established plantings ONLY. - Add DEVRINOL to tank first then agitate and add GRAMOXONE. - Apply in 1,100 L/ha water (440 L/ac). - Use on trees established one year or more. - Avoid contact with green bark, leaves or fruit.
paraquat plus napropamide	1.1 kg/ha 4.5 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	- Established plantings ONLY. - Apply as a directed spray before weeds are 30 cm high. - Use 110–330 L/ha water (44–132 L/ac). - Where weed growth is heavy, use the higher rate and larger water volume. - Do NOT apply closer than 40 days to harvest. - For trees established at least one year.
glufosinate ammonium	0.405–0.75 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration), active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
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PEARS

Site Preparation Before Planting – See Chapter 6, *Preplant Weed Control*, page 81.

Recommended rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water.

CAUTION – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.

Soil Applied Grass and Broadleaf Herbicides

CASORON G-4 (4 Gr)	110–175 kg/ha	44–70 kg/ac	• Established plantings ONLY. • PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. • Do NOT apply if air temperatures are above 10–15°C to avoid injury from volatilization. • Do NOT apply until 4 weeks after transplanting. • Do NOT use on light sandy soils. • 70 g of CASORON G-4 applied to an area 2x2 m is equivalent to 175 kg/ha (70 kg/ac).
dichlobenil	4.4–7 kg/ha		
CHATEAU WDG (51.1%)	0.28–0.42 kg/ha	0.11–0.16 kg/ac	
flumioxazin	0.14–0.21 kg/ha		
DEVRINOL DF (50 DF)	9 kg/ha	3.6 kg/ac	• Established plantings ONLY. • Apply to dormant pears ONLY. • Apply using ground application ONLY. • Do NOT apply to trees established less than one year.
napropamide	4.5 kg/ha		
DEVRINOL DF (50 DF) plus PRINCEP NINE-T (90 WG)	7 kg/ha 2.25 kg/ha	2.8 kg/ac 0.9 kg/ac	
napropamide plus simazine	3.5 kg/ha 2 kg/ha		
DEVRINOL DF (50 DF) plus SINBAR (80 WP)	9 kg/ha 0.6 kg/ha	3.6 kg/ac 0.24 kg/ac	• Planting year ONLY. • PRE – Apply in the fall through early spring before weeds emerge. • Do NOT apply on frozen ground or during harvest. • Make ONLY one application in the planting year. • Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide plus terbacil	4.5 kg/ha 0.48 kg/ha		
DUAL II MAGNUM (915 g/L)	1.75 L/ha	0.7 L/ac	
s-metolachlor/benoxacor	1.6 kg/ha		
DUAL II MAGNUM (915 g/L) plus LEXONE DF (75 DF)	1.75 L/ha 1 kg/ha	0.7 L/ac 0.4 kg/ac	• Established plantings ONLY. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with trunk and leaves of trees. • Do NOT use on sandy soil with less than 2% organic matter.
s-metolachlor/benoxacor plus metribuzin	1.6 kg/ha 0.75 kg/ha		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
DUAL II MAGNUM (915 g/L) plus PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha 1.1–2.5 kg/ha	0.5–0.7 L/ac 0.44–1 kg/ac	• New and established plantings. • PRE – Apply once per year as a band treatment under the trees before weeds emerge, preferably after rain has settled the soil around the trees. • Do NOT use on sandy soils with less than 2% organic matter. • Avoid contact with tree trunks and leaves. • Use the high rate on established plantings. • Late season crabgrass and fall panicum may escape this treatment.
<i>s-metolachlor/benoxacor</i> plus simazine	1.14–1.6 kg/ha 1–2.25 kg/ha		
KERB (50 WSP)	4.5 kg/ha	1.8 kg/ac	• Established plantings ONLY. • PRE – Apply from late September to early November when soil is cool and moist but not frozen. • Use ONLY under pear trees established at least one year. • 4.5 kg/ha is equivalent to 45 g/100 m².
<i>propyzamide</i>	2.25 kg/ha		
LEXONE DF (75DF)	0.5–1 kg/ha	0.2–0.4 kg/ac	• New and established plantings. • PPI before planting trees. • PRE – Apply once per year as a band treatment under the trees before weeds emerge. • Avoid contact with tree trunks and leaves. • Use high rate on established plantings.
<i>metribuzin</i>	0.38–0.75 kg/ha		
LOROX DF (50 DF)	8.6 kg/ha	3.44 kg/ac	• Established plantings ONLY. • PRE – Apply as directed spray before weeds are 10 cm high. • Apply in 400–600 L/ha water (160–240 L/ac). Add a surfactant. • Avoid contact with fruit, foliage or tree bark with spray or drift. • Use ONLY under trees established at least 10 years.
<i>linuron</i>	4.3 kg/ha		
PRINCEP NINE-T (90 WG)	2.5–5 kg/ha	1–2 kg/ac	• Established plantings ONLY. • PRE – Apply in 300–1,000 L/ha water (120–400 L/ac). • Use ONLY under trees planted for one year or more. • Use higher rate on perennial weeds such as quackgrass. • May be combined with glyphosate.
or SIMADDEX (500 g/L)	4.5–9 L/ha	1.8–3.6 L/ac	
or SIMAZINE 480 (480 g/L)	4.7–9.4 L/ha	1.88–3.76 L/ac	
<i>simazine</i>	2.25–4.5 kg/ha		
SENCOR 75 DF (75 WG)	0.55–0.75 kg/ha	0.22–0.3 kg/ac	• Planting year ONLY. • PPI before planting trees as an orchard floor or planting row treatment. • Apply once in the planting year ONLY.
plus TREFLAN EC (480 g/L)	1.2–2.4 L/ha	0.48–0.96 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
<i>metribuzin</i> plus trifluralin	0.42–0.56 kg/ha 0.6–1.15 kg/ha		
SINBAR (80 WP)	1.25 kg/ha	0.5 kg/ac	• Planting year. • PRE – Apply after planting trees, before weeds emerge. • Do NOT use on soils with less than 3% organic matter. • Avoid contact with tree trunks and leaves.
<i>terbacil</i>	1 kg/ha		

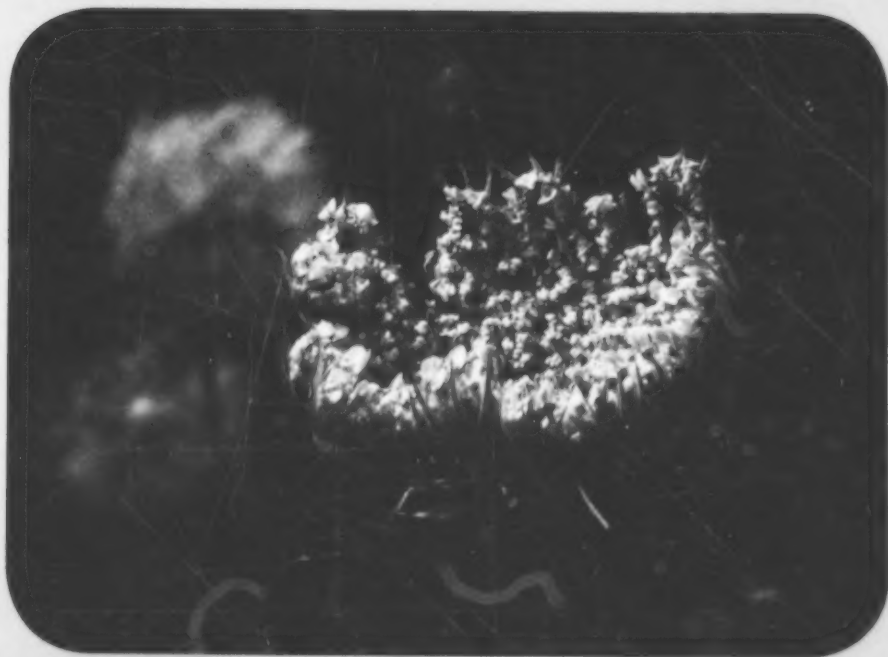
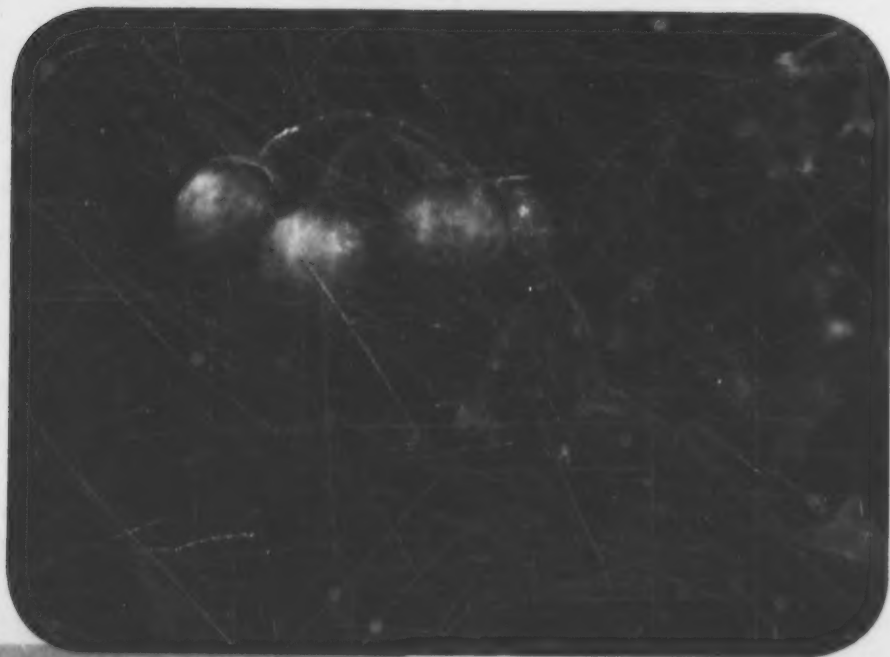
TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
SINBAR (80 WP) plus LEXONE DF (75DF)	0.63 kg/ha 1 kg/ha	0.25 kg/ac 0.4 kg/ac	• Established plantings. • PRE – Apply as a band under trees before weeds emerge. • Use ONLY one application per year. • Do NOT use on soil coarser than sandy loam with less than 3% organic matter.
terbacil plus metribuzin	0.5 kg/ha 0.75 kg/ha		
TREFLAN EC(480 g/L) or BONANZA 400 (400 g/L)	1.2–2.4 L/ha 1.5–2.75 L/ha	0.48–0.96 L/ac 0.6–1.1 L/ac	• Planting year ONLY. • PPI – Apply and incorporate before planting trees. • Use at least 100 L/ha water (40 L/ac). • Apply as a broadcast treatment or within the planting row. • Apply ONLY once in the year of planting.
trifluralin	0.6–1.15 kg/ha		
Postemergence Grass Herbicides			
POAST ULTRA (450 g/L) plus MERGE	0.32–1.1 L/ha 1–2 L/ha	0.13–0.45 L/ac 0.4–0.8 L/ac	• New and established plantings. • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha. • For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. • Do NOT apply closer than 25 days to harvest.
sethoxydim plus surfactant/solvent	0.15–0.5 kg/ha 1–2 L/ha		
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• New and established plantings. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses 2 leaf for foxtails. • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Apply ONLY once per year. • Grasses emerging after the treatment will not be controlled.
fluzifop-p-butyl	0.075–0.25 kg/ha		
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2 L/ha 1.68 L/ha 1.44 L/ha	0.8 L/ac 0.67 L/ac 0.58 L/ac	• Established plantings ONLY. • For broadleaf weeds, including dandelion, seedling Canada thistle and sow thistle. • Apply in early spring after weeds emerge or postharvest to actively growing weeds. • Do NOT apply when usable fruit is on the orchard floor. • Do NOT apply closer than 80 days to harvest.
2,4-D*	0.95 kg/ha		
AIM EC (240 g/L) plus AGRAL 90 or AG-SURF or MERGE	36.5–117 mL/ha 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	14.8–47 mL/ac 2.5 L/1,000 L 2.5 L/1,000 L 1 L/1,000 L	• New and established plantings. • Apply POST with a HOODED SPRAYER between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/ac) water. • Do NOT apply closer than 3 days to harvest. • Apply ONLY once per growing season. • AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
carfentrazone-ethyl plus non-ionic surfactant or surfactant/solvent	8.8–28.1 g/ha 0.25% v/v 0.1% v/v		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
BASAGRAN (480 g/L) plus ASSIST	1.75–2.25 L/ha 1–2 L/ha	0.7–0.9 L/ac 0.4–0.8 L/ac	• Planting year ONLY. • Directed spray only. Do not overspray. • Apply in 100–400 L/ha water (40–160 L/ac) with at least 275 kPa pressure. • Avoid tree leaves. • Use lower rate of ASSIST under hot, humid conditions. • Make ONLY 2 applications, 10 days apart at the low rate, in the planting year.
bentazon plus oil concentrate	0.84–1.08 kg/ha 1–2 L/ha		
Non-Selective Herbicides and Tank Mix Options			
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.25–12 L/ha 1.69–9 L/ha 1.62–8.64 L/ha 1.5–8 L/ha	0.9–4.8 L/ac 0.68–3.6 L/ac 0.65–3.5 L/ac 0.6–3.2 L/ac	• Established plantings ONLY. • For actively growing weeds. • Apply in 200–300 L/ha water (80–120 L/ac) as a directed spray. • Remove all suckers from base of trunks before application. • Do NOT apply to trees with “green” bark in the area of application. • Do NOT mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • Do NOT apply closer than 30 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-23. <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
glyphosate*	0.81–4.32 kg/ha		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1 L/2 L water 0.75 L/2 L water 0.72 L/2 L water 0.67 L/2 L water		• Established plantings ONLY. • Apply with a rope wick or other similar device when weeds are at the optimum stage. • Avoid contact with the leaves, trucks and suckers. • Do NOT apply when weeds are wet. • See <i>Wiper Applicators for Selective Weed Control</i>, page 9. • Do NOT apply closer than 30 days to harvest.
glyphosate*	0.36 kg/2 L		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	1–2 L/100 L water 0.75–1.5 L/100 L water 0.72–1.44 L/100 L water 0.67–1.34 L/100 L water		• Established plantings ONLY. • Use hand held sprayers as a spot treatment if wiper equipment is not available. • Avoid contact with leaves, trucks and suckers. • Do NOT apply closer than 30 days before harvest.
glyphosate*	0.36–0.72 kg/100 L		
GRAMOXONE (200 g/L)	5.5 L/ha	2.2 L/ac	• Established plantings ONLY. • Apply in 1,100 L/ha (440 L/ac) water. • For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit. • May be used in mixtures with DEVRINOL or PRINCEP.
paraquat	1.1 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
GRAMOXONE (200 g/L) plus DEVRINOL DF (50 DF)	5.5 L/ha 9 kg/ha	2.2 L/ac 3.6 kg/ac	• Established plantings ONLY. • Add DEVRINOL to tank first then agitate and add GRAMOXONE. • Apply in 1,100 L/ha water (440 L/ac). • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit.
<i>paraquat</i> <i>plus napropamide</i>	1.1 kg/ha 4.5 kg/ha		
GRAMOXONE (200 g/L) plus PRINCEP NINE-T (90 WG)	5 L/ha 2–2.5 kg/ha	2 L/ac 0.8–1 kg/ac	• Established plantings ONLY. • To control emerged weeds and provide residual control of germinating weeds. • Use on trees established one year or more. • Avoid contact with green bark, leaves or fruit. • See Precautions on GRAMOXONE and PRINCEP above.
<i>paraquat</i> <i>plus simazine</i>	1 kg/ha 1.8–2.25 kg/ha		
IGNITE (150 g/L)	2.7–5 L/ha	1.08–2 L/ac	• Established plantings ONLY. • Apply as a directed spray before weeds are 30 cm high. • Use 110–330 L/ha water (44–132 L/ac). • Where weed growth is heavy, use the higher rate and larger water volume. • Do NOT apply closer than 40 days to harvest. • For trees established at least one year.
<i>glufosinate ammonium</i>	0.405–0.705 kg/ha		
IGNITE (150 g/L) plus PRINCEP NINE-T (90 WG) or SIMADEX (500 g/L)	2.7–5 L/ha 2–5 kg/ha 4.5–9 L/ha	1.08–2 L/ac 0.8–2 kg/ac 1.8–3.6 L/ac	• Established plantings ONLY. • To control emerged weeds plus residual control of annual grasses and broadleaf weeds. • Use as a directed spray around the bases of trees established at least one year. • Do NOT apply closer than 40 days to harvest. • See Precautions on IGNITE and PRINCEP.
<i>glufosinate ammonium</i> <i>plus simazine</i>	0.405–0.75 kg/ha 1.8–4.5 kg/ha		



16. NURSERY & ORNAMENTAL CROPS

In April of 2009, the Ministry of Environment amended the *Pesticides Act* with the *Cosmetic Pesticides Ban Act, 2008* and Ontario Regulation 63/09. Pesticides are now classified for sale and use under 11 different classes. It should be noted that agriculture (e.g. nursery production) is exempted. For more information on the legislation see the Ministry of the Environment's website at www.ontario.ca/pesticideban

To convert kg/ha or L/ha to g/100 m² or mL/100 m² – Multiply by 10 and change units.
For example – 11 kg/ha becomes 110 g/100 m²
28.4 L/ha becomes 284 mL/100 m²

PREPLANT INCORPORATED (PPI) – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/hr) or vibrating shank S-tine

cultivator (10–13 km/hr) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

PREEMERGENCE (PRE) – Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

POSTEMERGENCE – Leaf stage of the weeds is critical for good weed control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to recommended leaf stages. Crop stage is important to optimize

crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

WARNING – Refer to manufacturer's instructions for waiting period required after planting.

WARNING – Certain species may be injured by the following herbicides. Check manufacturer's directions for labeled species before use.

For the latest information on Nursery and Ornamental Crops subscribe to the OMAFRA Nursery and Landscape Report by going to <http://www.omafra.gov.on.ca/english/crops/podcast/nursery/standard.xml>.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Crop tolerance ratings are: E – Excellent, G – Good, F – Fair, P – Poor. Under unfavourable conditions (e.g. too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 16-1. Nursery Herbicide Weed Control Ratings

Trade Name	Annual Grass					Annual Broadleaves							Perennial Weeds																			
	barnyard grass	crabgrass	fall panicum	foxtail	witch grass	chickweed, common	groundsel	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweeds	brome grass	chickweed, mouse-eared	dandelion	grape, wild	ground-ivy (creeping charlie)	horsetail	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	toadflax, yellow	vetches	virginia creeper	
Soil Applied Grass Herbicides																																
KERB	8	7	8	8	8	7	-	7	8	8	7	7	-	8	-	-	-	-	5	-	6	6	-	-	6	-	-	6	-	-	-	
Soil Media Applied Broadleaf Herbicides																																
BROADSTAR	3	3	3	5	3	8	8	7	9	-	9	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
GALLERY	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SUREGUARD	3	3	3	5	3	8	8	7	9	-	9	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Soil Media Applied Grass and Broadleaf Herbicides																																
CASORON	7	6	6	6	7	8	8	8	8	8	8	8	7	5	7	7	5	6	8	-	-	7	7	-	7	7	-	7	-	7	-	
DACTHAL W 75	8	8	8	8	8	8	0	0	8	2	6	4	-	-	8	7	-	-	-	-	0	0	-	0	-	-	-	-	-	-	-	-
DEVRIOL	8	9	8	8	8	7	7	6	8	5	8	7	5	8	-	5	-	-	5	-	5	6	-	-	5	5	-	5	-	5	-	
DUAL II MAGNUM	9	9	9	9	9	-	-	2	7	2	7	4	-	0	-	-	-	-	-	-	8/9	-	-	0	-	-	-	-	-	-	-	-
ECOCLEAR	-	9	-	9	-	9	-	-	9	9	-	8	-	-	9	7	-	-	-	-	-	-	7	-	7	-	-	-	7	7	-	
RONSTAR 2G	7	8	-	8	-	5	8	-	8	8	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SIMADEx or SIMAZINE 480 or PRINCEP NINE-T	8	7	6	8	8	8	8	9	9	9	9	8	5	8	-	-	-	-	5	-	5	6	-	-	6	5	-	5	-	5	-	
TREFLAN or BONANZA or RIVAL	9	9	8	8	8	7	5	2	8	2	8	2	2	-	7	-	-	-	4	-	5	5	-	-	2	2	-	2	-	2	-	
Postemergence Grass Herbicides																																
VENTURE L	8	8	8	8	9	0	0	0	0	0	0	0	-	8	3	3	3	3	-	3	-	-	3	3	8	-	3	-	3	3	3	
Postemergence Grass and Broadleaf Herbicides																																
glyphosate*	9	9	9	9	9	9	9	9	9	9	9	9	8	8	9	8*	8	5	5	5	9	8*	9	9	9	9	5	9	-	5*	8	

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23.

¹ Do not allow spray to contact green bark or leaves of crop.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

- Insufficient information available to make a rating.

^a Use higher rates for weeds larger than 15 cm tall or across.

TRADE NAME
(Formulation)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

RATE PRODUCT
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

HERBACEOUS ORNAMENTALS

Site Preparation Before Planting – See Chapter 6. *Preplant Weed Control*, page 81.

Herbaceous Ornamentals – Soil Applied Grass and Broadleaf Herbicides

DACTHAL W-75 (75 WP)	17 kg/ha	6.8 kg/ac	• Apply at lining out, late fall or early spring in 340 L of water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or irrigation (1 cm) is needed to activate this herbicide. • Do NOT use on Germander, Telanthera, Ajuga, Mesembryanthemum, Dianthus, Viola Phlox and Vinca minor.
chlorthal dimethyl	12.75 kg/ha		
TREFLAN EC(480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac	• PPI – Must be incorporated before transplanting. • Do NOT use for seeded annuals. • Check label for list of tolerant species. • Check label for application rate as it varies with soil type.
or RIVAL EC (500 g/L)	1.2–2.2 L/ha	0.48–0.94 L/ac	
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	
trifluralin	0.6–1.155 kg/ha		

Herbaceous Ornamentals – Postemergent Grass Herbicides

VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• For Campanula and Sedum – direct spray ONLY to avoid contact with crop. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Many species are tolerant in field production only. Consult the label for list of tolerant species.
fluzifop-p-butyl	0.075–0.25 kg/ha		

SHELTERBELTS (WINDBREAKS) ESTABLISHED

Cultural Weed Control – See *Cultural Weed Control in Fruit Crops*, page 265.

Site Preparation Before Planting – See Chapter 6. *Preplant Weed Control*, page 81.

Established Shelterbelts and Windbreaks – Soil Applied Grass and Broadleaf Herbicides

CASORON 4G (4 Gr)	110–175 kg/ha	44–70 kg/ac	• PRE – Apply in early spring or late fall. • Use the lower rate for spring application. • Tolerant species include cedar, linden, maple, willow, caragana and ash. Reduce rates on lighter soils.
dichlobenil	4.4–7 kg/ha		
DACTHAL W-75 (75 WP)	17 kg/ha	6.8 kg/ac	• Apply at lining out, late fall or early spring in 340 L of water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or irrigation (1 cm) is needed to activate this herbicide.
chlorthal dimethyl	12.75 kg/ha		

TRADE NAME (Formulation) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
PRINCEP NINE-T (90WG) or SIMAZINE 480 (480 g/L)	2.5–3.75 kg/ha 4.7–7 L/ha	1–1.5 kg/ac 1.88–2.8 L/ac	• PRE – Apply in 500 L/ha (200 L/ac) water. • Apply in the fall or spring prior to weed emergence or after emerged weeds have been removed. • Windbreak species must be established for at least 1 year. • Tolerant species include cedar, spruce, black walnut, white ash, green ash, elm, boxelder, maple and caragana. • Check label for species which will tolerate higher rates of simazine. Apply before buds break in spring. • Use low rate for sandy soils or low organic matter soils.
simazine	2.25–3.37 kg/ha		
TREFLAN EC(480 g/L) or BONANZA 400 (400 g/L)	1.25–2.4 L/ha 1.5–2.75 L/ha	0.5–0.96 L/ac 0.6–1.1 L/ac	
trifluralin	0.6–1.155 kg/ha		• PPI – Apply as a directed spray to the soil surface around the trees or shrubs. • Incorporate as closely as possible to the trees and shrubs without causing damage to their roots.
Established Shelterbelts and Windbreaks – Postemergent Grass Herbicides			
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application.
fluazifop-p-butyl	0.075–0.25 kg/ha		
Established Shelterbelts and Windbreaks – Postemergent Grass and Broadleaf Herbicides			
glyphosate (360 g/L) or glyphosate (450 g/L) or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	0.75–12 L/ha 0.6–9.6 L/ha 0.56–9 L/ha 0.54–8.64 L/ha 0.5–8 L/ha	0.3–4.8 L/ac 0.24–3.84 L/ac 0.22–3.6 L/ac 0.22–3.5 L/ac 0.2–3.2 L/ac	• For actively growing weeds in the fall, or spring prior to emergence of any crop. • Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • For specific information on product rates and notes for annual and perennial weed control refer to Table 6-3, <i>Postharvest Weed Control Ratings</i>, page 83.
glyphosate*	0.27–4.32 kg/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Formulation)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

RATE PRODUCT
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23 and Chapter 5. *Notes on Adjuvants*, page 69).

SHELTERBELTS (WINDBREAKS) TRANSPLANTED

Site Preparation Before Planting – See Chapter 6. *Preplant Weed Control*, page 81.

Transplanted Shelterbelts and Windbreaks – Soil Applied Grass and Broadleaf Herbicides

TREFLAN EC(480 g/L)	1.25–2.4 L/ha	0.5–0.96 L/ac	• PPI – Apply after a clean cultivation, and incorporate after application.
or RIVAL EC (500 g/L)	1.2–2.2 L/ha	0.48–0.94 L/ac	• Transplant the trees or shrubs so that most of their root system is placed below the treated layer of soil.
or BONANZA 400 (400 g/L)	1.5–2.75 L/ha	0.6–1.1 L/ac	

trifluralin 0.6–1.155 kg/ha

Transplanted Shelterbelts and Windbreaks – Postemergent Grass Herbicides

VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply to actively growing grasses prior to tillering.
fluzifop-p-butyl	0.075–0.25 kg/ha		• Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn.
			• Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley.
			• Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails).
			• Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly.
			• Thorough preplant tillage, fragmenting quackgrass rhizomes improves control.
			• Do NOT cultivate between rows until 5 days after application.

WOODY NURSERY STOCK – FIELD GROWN NURSERY STOCK

Cultural Weed Control – See *Cultural Weed Control in Fruit Crops*, page 265.

Mechanical weed control such as cultivation and hand hoeing will provide weed control in sensitive species as well as provide control of weed escapes. Cultivators are available which will work in between trees and in the row.

Site Preparation Before Planting – See Chapter 6. *Preplant Weed Control*, page 81.

WARNING – Refer to manufacturers' instructions for waiting period required after planting.

WARNING – Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.

Woody Nursery Stock (Field Grown) – Soil Applied Grass Herbicides

KERB (50 WP)	3 kg/ha	1.2 kg/ac	• PRE – Apply in the late fall when the soil temperature is low but above freezing.
propyzamide	1.5 kg/ha		• Soil moisture should be high.
			• This herbicide is absorbed through the roots.
DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha	0.5–0.7 L/ac	• PRE – Apply in at least 150 L of water.
s-metolachlor/benoxacor	1.14–1.6 kg/ha		• Apply to soil prior to bud break of nursery stock.
			• Do NOT apply within 4 weeks of bud burst or until the needles have hardened.
			• For use on white spruce, Norway spruce, black spruce, white pine, Jack pine and red pine seedlings in their second year or older.
			• Also for use on poplar stoolbeds.
			• May have postemergent properties if applied to weeds before they reach the 2 leaf stage.

TRADE NAME (Formulation) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
Woody Nursery Stock (Field Grown) – Soil Applied Broadleaf Herbicides			
SUREGUARD (51.1%) flumioxazin	280–420 g/ha 143–215 g/ha	112–168 g/ac	• For preemergent weed control in field-grown ornamental deciduous and coniferous trees, including Christmas trees and trees produced for reforestation. • Tolerant species include: <i>Abies balsamea</i>, <i>Abies fraseri</i>, <i>Acer ginnala</i>, <i>Fraxinus pennsylvanica</i>, <i>Picea pungens</i>, <i>Pseudotsuga menziesii</i>, <i>Syringa reticulata</i> and <i>Thuja occidentalis</i>. • Do not apply to fine-textured soils. • SUREGUARD should be applied to tilled, weed-free deciduous tree plantings. • Only apply to healthy established trees. • Do not incorporate into soil after application. • Do not apply to moist or wet plant foliage. • Do not make more than two applications in a growing season. • SUREGUARD can also be used to maintain bare-ground non-crop areas in and around ornamental nurseries and field-grown ornamentals.
GALLERY (75 DF) isoxaben	1 kg/ha 0.75 kg/ha	0.4 kg/ac	• PRE – For use in bareroot and container conifer seedlings. • Applied prior to weed emergence in conifers, four or more weeks after crop germination and emergence. • Rainfall or irrigation is needed to activate the herbicide.
Woody Nursery Stock (Field Grown) – Soil Applied Grass and Broadleaf Herbicides			
CASORON 4G (4 Gr) dichlobenil	110–175 kg/ha 4.4–7 kg/ha	44–70 kg/ac	• PRE – Apply in late fall or early spring. • Use lower rate for spring application. • Do NOT apply until 4 weeks after transplanting second year stock. • Reduce rate on lighter soil.
DACTHAL W-75 (75 WP) chlorthal dimethyl	17 kg/ha 12.75 kg/ha	6.8 kg/ac	• Apply at lining out, late fall or early spring in 340 L of water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or Irrigation (1 cm) is needed to activate this herbicide.
DEVIRINOL DF (50 DF) or DEVIRINOL 10G (10 Gr) napropamide	9 kg/ha 45 kg/ha 4.5 kg/ha	3.6 kg/ac 18 kg/ac	• PPI – Apply any time of the year to a clean cultivated soil surface or before weeds germinate. • Use only once prior to or during a growing season. • DEVIRINOL must reach the zone of weed germination, either by mechanical incorporation or by adequate irrigation or precipitation. • Shallow incorporation to a chemical depth of 2.5–5.0 cm or an irrigation with sufficient water to wet the soil to depth of 5–10 cm should occur within 7 days of a spring or fall application and within 2 days of a summer application. • Fall applications will control weeds the following spring and summer. • Caution – Residues high enough to harm many crops may persist after repeated applications in perennial crops.
DEVIRINOL DF (50 DF) plus SIMAZINE 80W (80 WP) napropamide plus simazine	9 kg/ha 1.37 kg/ha 4.5 kg/ha 1.1 kg/ha	3.6 kg/ac 0.55 kg/ac	• PPI – Apply before weeds emerge on established plantings only. • Will provide additional control of broadleaf weeds. • See Precautions under DEVIRINOL and SIMAZINE.

TRADE NAME (Formulation) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE*	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
PRINCEP NINE-T (90WG) or SIMADEX (500 g/L)	2.5–3.75 kg/ha 3.6–13.5 L/ha	1–1.5 kg/ac 1.44–5.4 L/ac	• PRE – Apply before weeds emerge on established plantings only. • Do NOT replant nursery stock into treated soil after stock is removed. • Do NOT use around ornamental shrubs if ground cover or bedding plants will be planted. • Caution – Residues high enough to harm many crops may persist after repeated applications.
simazine	2.25–3.4 kg/ha		
TREFLAN EC (480 g/L) or RIVAL EC (60 DF)	1.25–2.4 L/ha 1–1.9 kg/ha	0.5–0.96 L/ac 0.4–0.76 kg/ac	• PPI – Must be incorporated immediately after application, after a clean cultivation. • This treatment does not control ragweed, annual nightshade or mustards. • Lady's-thumb may also escape the treatment.
trifluralin	0.6–1.155 kg/ha		
Woody Nursery Stock (Field Grown) – Postemergent Grass Herbicides			
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application. • Consult the label for list of tolerant and sensitive species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. Some blue junipers (e.g. 'Bar Harbour', 'Blue Acres', and 'Blue Rug') can be injured by over-the-top applications. • Caution – There are differences between cultivars in sensitivity to VENTURE L (e.g. <i>Juniperus horizontalis</i> 'Blue Acres' is sensitive while <i>Juniperus horizontalis</i> 'Plumosa Compacta' is tolerant). • Test on samples of each cultivar not specifically listed on the label before using the herbicide or use as a directed application.
fluzafop-p-butyl	0.075–0.25 kg/ha		
Woody Nursery Stock (Field Grown) – Postemergent Grass and Broadleaf Herbicides			
2,4-D AMINE (470 g/L)* plus GLYFOS (360 g/L)	1 L/ha 1 L/ha	0.4 L/ac 0.4 L/ac	• Ground directed spray only. • Apply ONLY to Balsam fir and Fraser fir. • Trees must be 1.2 metres high and spray should not touch the branches.
2,4-D* plus glyphosate	0.470 kg/ha 0.360 kg/ha		• Apply once per year in June. • Apply mix in 100 L of water/ha.

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Formulation) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
AMITROL 240	1.7–3.0 L/ha	0.68–1.2 L/ac	• To be applied ONLY on spruce (<i>Picea spp.</i>). • Apply postemergence to actively growing plants, good coverage is essential. • If weeds are mature, it is advisable to cut them and then spray the re-growth. • Do NOT disturb treated plants for 2 weeks after application. • Do NOT make postharvest applications after October 1. • To control quackgrass and Canada thistle, apply in the spring or fall to actively growing plants that are 15–20 cm tall. Wait 10–14 day and then plough or disk. • Avoid application to the crop during periods of rapid shoot elongation in the spring. • Applications can be made in the first year (0.68 L/ac) in either seedbed or transplants, but only after the seedlings have set bud. • The rate may be increased to 1.2 L/ac for actively growing seedlings or transplant bare-root spruce beyond the first year.
amitrole	0.39–0.69 kg/ha		
glyphosate (360 g/L)*	0.75–12 L/ha	0.3–4.8 L/ac	• For actively growing weeds in the fall, or spring prior to emergence of any crop. • Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • For specific information on product rates and notes for annual and perennial weed control refer to Table 6-3. <i>Postharvest Weed Control Ratings</i>, page 83.
or glyphosate (450 g/L)	0.6–9.6 L/ha	0.24–3.84 L/ac	
or glyphosate (480 g/L)	0.56–9 L/ha	0.22–3.6 L/ac	
or glyphosate (500 g/L)	0.54–8.64 L/ha	0.22–3.5 L/ac	
or glyphosate (540 g/L)*	0.5–8 L/ha	0.2–3.2 L/ac	
glyphosate*	0.27–4.32 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Formulation)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

RATE PRODUCT
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

WOODY NURSERY STOCK – CONTAINER BEDS

CULTURAL WEED CONTROL – A successful weed control program must integrate cultural and chemical weed control practices.

Prepare the container bed area with a gravel layer and/or ground covers such as black plastic or opaque woven material. It is important that these surface covers exclude light in order to be effective in preventing weed seed germination. These ground covers can be used for a number of years before being replaced.

Keep the container beds and roadways free of weeds by physical removal or chemical mowing. Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weed escapes before they set seed by cultural removal or chemical mowing. In some situations, such as along fences, tools such as a weed whip may be useful. Look for the source of weeds that disseminate into container areas such as poplars, willows, willowherb and Canada fleabane.

Control weeds around irrigation ponds so that small seeded weeds are not being sown into container stock with each watering. A vigorous grassed bank will help reduce weed infestations as well as providing bank stabilization. A filtering system in the irrigation line will remove weed seeds.

Removal of existing weeds from container stock before they flower **must be a priority job**. Once a weed flowers it can disseminate hundreds of seeds by wind or by catapulting seeds. Many container weed species have several generations per year because their seeds do not need to overwinter before germinating. Remove and discard all pulled weeds well away from the growing area so that seeds are not disseminated into nearby containers.

Since many species of container weeds overwinter in the protected environment of a polyhouse, it is important to thoroughly weed container stock in the fall. Be sure to remove the rosettes of winter annuals such as shepherd's-purse and Canada fleabane and established plants and seedlings of common and mouse-eared chickweed. If not removed, these plants will be flowering by May or earlier.

WARNING – Refer to manufacturer's instructions for waiting period required after planting.

WARNING – Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.

Container Bed Preparation – Soil Applied Grass and Broadleaf Herbicides

CASORON 4G (4 Gr)	110–175 kg/ha	44–70 kg/ac	• PRE – Apply to bare soil before putting container pots on beds. • Apply in spring when temperatures are cool and incorporate immediately with irrigation or mechanical incorporation. • For the best results, apply to soil with more than 2% organic matter content. • Use on gravel or sandy soils may result in inconsistent weed control. • Do NOT cover polyhouses with plastic within 1 month after application. • Do NOT apply within plastic covered polyhouses or within greenhouse structures. • Refer to label for tolerant species. • Do NOT transplant into treated soil for 1 year.
<i>dichlobenil</i>	4.4–7 kg/ha		
DACTHAL W-75 (75 WP)	17 kg/ha	6.8 kg/ac	• Apply at lining out, late fall or early spring in 340 L of water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or irrigation (1 cm) is needed to activate this herbicide.
<i>chlorthal dimethyl</i>	12.75 kg/ha		
DEVIRINOL 2G (2Gr)	225 kg/ha	90 kg/ac	• Consult list of plant species on which DEVIRINOL 2G can be used. • Apply over the container and treat preemergence to the weeds. If weeds are emerged cultivate before application. • Irrigate immediately after application.
<i>napropamide</i>	4.5 kg/ha		

TRADE NAME (Formulation) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69)
Container Bed Preparation – Postemergent Grass and Broadleaf Herbicides			
glyphosate (360 g/L)*	0.75–12 L/ha	0.3–4.8 L/ac	• For actively growing weeds in the fall, or spring prior to emergence of any crop. • Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • For specific information on product rates and notes for annual and perennial weed control refer to Table 4-3, <i>Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops</i>, page 60.
or glyphosate (450 g/L)	0.6–9.6 L/ha	0.24–3.84 L/ac	
or glyphosate (480 g/L)	0.56–9 L/ha	0.22–3.6 L/ac	
or glyphosate (500 g/L)	0.54–8.64 L/ha	0.22–3.5 L/ac	
or glyphosate (540 g/L)*	0.5–8 L/ha	0.2–3.2 L/ac	
glyphosate*	0.27–4.32 kg/ha		
Woody Nursery Stock – (Container Grown)			
Do NOT apply herbicides within covered polyhouses, or within four weeks before covering. Certain types of container stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.			
Woody Nursery Stock (Container Grown) – Soil Applied Broadleaf Herbicides			
BROADSTAR (0.25%)	84–168 kg/ha	33.6–67.2 kg/ac	• For preemergent weed control on outdoor container-grown woody ornamentals. • For use on: <i>Acer ginnala</i>, <i>Acer palmatum</i>, <i>Buxus sempervirens</i>, <i>Juniperus horizontalis</i>, <i>Juniperus Sabina</i>, <i>Picea pungens</i>, <i>Picea glauca</i>, <i>Quercus rubra</i>, <i>Taxus x media</i>, <i>Thuja occidentalis</i>. • Apply before germination of target weeds or immediately after disturbing the soil surface. • BROADSTAR can be safely applied over the top of many species of woody ornamental shrubs and trees providing the user follows the label directions. • Apply to dry foliage only. • Do not apply more than twice in a single year. • See product label for more information.
flumioxazin	21–42 kg/ha		
GALLERY (75 DF)	1 kg/ha	0.4 kg/ac	
isoxaben	0.75 kg/ha		
Woody Nursery Stock (Container Grown) – Soil Applied Grass and Broadleaf Herbicides			
dichlobenil	4.4 kg/ha		• PRE – Apply at least 4 weeks after planting into containers to a weed-free soil surface. • Do NOT use after September 15 or within 30 days of covering treated stock in overwintering structures. • Use only on containers growing outside. • For use on these species – <i>Juniperus chinensis</i>, <i>J. horizontalis</i> and <i>Thuja occidentalis</i>.
CASORON 4G (4 Gr)	110 kg/ha	44 kg/ac	

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Formulation) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
DACTHAL W-75 (75 WP)	17 kg/ha	6.8 kg/ac	• Apply at lining out, late fall or early spring in 340 L of water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or Irrigation (1 cm) is needed to activate this herbicide.
<i>chlorthal dimethyl</i>	12.75 kg/ha		
DEVIRINOL DF (50 DF)	9 kg/ha	3.6 kg/ac	• PPI – Apply at any time of the year to a weed-free soil surface.
or DEVIRINOL 10G (10 Gr)	45 kg/ha	18 kg/ac	• May be applied to newly planted container stock after the potting media has settled from first watering.
<i>napropamide</i>	4.5 kg/ha		• Incorporate by watering within 7 days of a spring or fall application and within 2 days of a summer application. • Will not control bittercress.
PRINCEP NINE-T (90 WG)	2.5 kg/ha	1 kg/ac	• PRE – Apply in 300 L/ha (120 L/ac) water. • For use on juniper, white cedar and yew ONLY.
<i>simazine</i>	2.25 kg/ha		• Apply ONLY once per season, 1 month after planting. • Apply before weeds emerge or after removing them from the containers.
RONSTAR 2G (2 Gr)	100–225 kg/ha	40–90 kg/ac	• PRE – Apply any time during the year, prior to weed seed germination. • Can be applied to both newly transplanted and established ornamentals and trees.
<i>oxadiazon</i>	2–4.5 kg/ha		• Do NOT apply to wet foliage or under conditions in which granules will collect on leaves. • Consult the label for list of tolerant species. • Apply at least 4 weeks before covering polyhouses in fall.
Woody Nursery Stock (Container Grown) – Postemergent Grass Herbicides			
VENTURE L (125 g/L)	0.6–2 L/ha	0.24–0.8 L/ac	• Apply to actively growing grasses prior to tillering. • Apply at 0.6 L/ha (0.24 L/ac) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/ac) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/ac) at 2–5 leaf stage of annual grasses (2–4 Leaf for foxtails). • Apply at 2 L/ha (0.8 L/ac) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • Do NOT cultivate between rows until 5 days after application. • Consult the label for list of tolerant species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. Some blue junipers (e.g. 'Bar Harbour', 'Blue Acres', and 'Blue Rug') can be injured by over-the-top applications. • Caution – There are differences between cultivars in sensitivity to VENTURE L. Example – <i>Juniperus horizontalis</i> 'Blue Acres' is sensitive while cv 'Plumosa Compacta' is tolerant. • Test on samples of each cultivar not specifically listed on the label before using the herbicide or use as a directed application.
<i>fluzafop-p-butyl</i>	0.075–0.25 kg/ha		

TRADE NAME
(Formulation)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

RATE PRODUCT
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

DRIVEWAYS, PATIOS AND PATHS

Driveways, Patios And Paths – Postemergent Grass and Broadleaf Herbicides

ECOCLEAR (25%)

1 L/3 L of water
or 1L/2.5 L of water

Acetic acid

(33–40% solution)

- Apply to young, actively growing weeds when temperatures are above 15°C.
- Complete coverage is necessary to achieve control.
- Use the low rate for annual weeds that are small (3–5 leaf).
- Use the high rate for larger annual weeds and perennial weeds.
- Weeds that are near maturity, flowering, dormant or hardened due to drought or temperature stress are more tolerant to ECOCLEAR treatments and may not be adequately controlled with a single application.
- A repeat application is effective for extended control of perennial weeds following initial burn down.
- Avoid application to reactive metals.

SEEDBEDS AND POTTING SOIL

Seedbeds and Potting Soil – Soil Applied Fumigants

BASAMID (98 Gr)

510 kg/ha

204 kg/ac

da:zomet

500 kg/ha

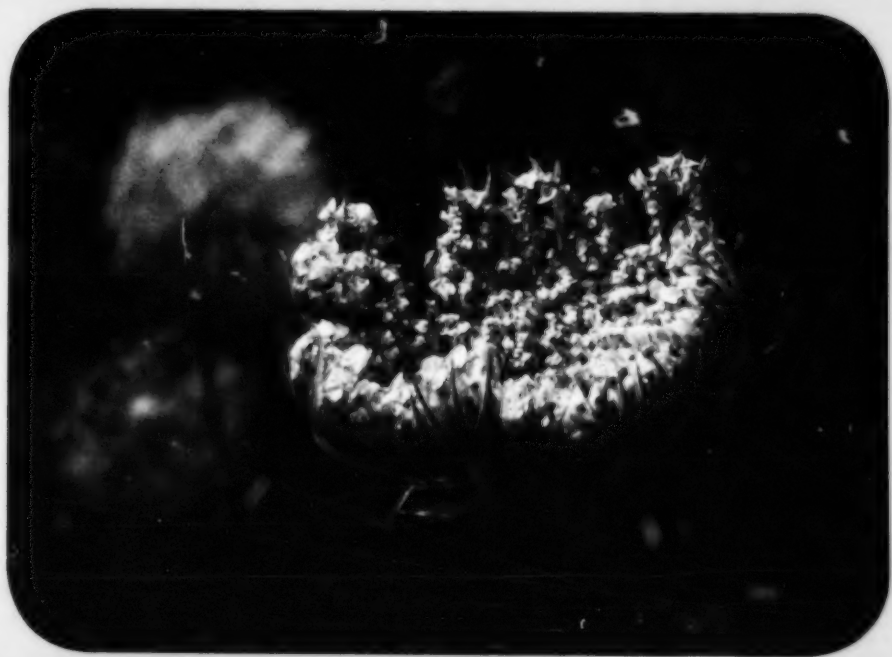
VAPAM (380 g/L)

10 L/100 m²
in 800 L water

metam sodium

3.8 kg/100 m²

- **Do NOT** use below 6°C.
- Refer to manufacturer's directions for specific details as well as direction on sealing soil, evacuating gases and performing the safety germination test.
- Apply as a drench to a soil that should be wet to a depth of at least 8 cm.
- **Do NOT** plant for 10–14 days or longer if the weather is cool.



17. TURFGRASS (GOLF COURSES, SOD FARMS & OTHER ACCEPTED USES)

In April of 2009, the Ministry of Environment ammended the *Pesticides Act* with the *Cosmetic Pesticides Ban Act, 2008* and Ontario Regulation 63/09. Pesticides are now classified for sale and use under 11 different classes. It should be noted that agriculture (e.g. nursery production) is exempted. For more information on the legislation see the Ministry of the Environment's website at www.ontario.ca/pesticideban.

To convert kg/ha or L/ha to g/100 m² or mL/100 m² – Multiply by 10 and change units.
For example – 11 kg/ha becomes 110 g/100 m²
28.4 L/ha becomes 284 mL/100 m²

Managing Weeds in Turfgrass

The major species of broadleaf weeds infesting turf in Ontario are dandelion, plantain, black medick, chickweed, prostrate knotweed, mallow, henbit, ground-ivy, and white clover. The major grassy weeds are crabgrass, annual bluegrass, quackgrass, orchard grass and bentgrass.

Cultural Practices to Manage Weeds in Turfgrass

The easiest, cheapest and most effortless way to keep turf fields free of weeds is to encourage vigorous growth of turfgrass. Most weeds cannot compete in a dense, healthy turf. Growth practices that encourage vigorous grass growth discourage weed infestations. Such practices include mowing, fertilizing, watering and drainage, controlling thatch, avoiding compaction, selecting the appropriate turfgrass and removing weeds mechanically.

Mowing stimulates bud development and tillering, inducing the sod to become thick and dense. Cut commonly grown grasses such as the fescues, bluegrasses and turf-type perennial ryegrasses to a height of 4–6 cm. Invasion by weeds may occur if grasses are cut shorter than 4 cm.

Avoid scalping the turf when cutting around trees and flowerbeds. Do not remove more than one-third of the leaf area when mowing. Mowing too frequently may reduce the carbohydrate reserves of the turf, thereby reducing its competitiveness. Mowing can also be used to remove annual weeds and eliminate seed production, reducing or preventing the spread of weeds.

Fertilizer is particularly important in establishing a thick, dense and healthy turf stand. Regular, timely fertilizer applications can help turf out-compete broadleaf and grassy weeds. Too few nutrients applied to the turf leads to increased susceptibility to weed infestation and some disease. Too much fertilizer may lead to soft, weak grass that is also prone to disease and will not stand up to traffic.

Watering is critically important when normal rainfall does not provide enough moisture. Irrigate weekly, using 2.0–2.5 cm of water per application to help produce thick, deep-rooted turf.

Frequent light irrigation will have the opposite effect on the grass roots. It encourages the germination and growth of shallow rooted species such as crabgrass and creeping bentgrass. Too much irrigation water will lead to infestation by yellow nutsedge and annual bluegrass. Provide adequate watering near trees and hedges because they compete for available moisture.

Drainage is important to ensure roots are healthy and functioning. Waterlogged soils do not provide roots with the air they need to function properly. Install adequate drainage if needed.

Compaction should be avoided to prevent invasion by weeds that thrive in compacted soil. Knotweed and annual bluegrass often invade turfgrass where compaction, caused by excessive traffic is a problem. While aeration practices do help, the best answer is to modify the area to reduce traffic. Immediate resodding or reseeding of damaged areas discourages weed infestations.

Select **turfgrass species** to match the growing environment and the intended use. For example, fescues are tolerant to low-light intensity in shaded areas under trees and also tolerate low maintenance. Turf-type perennial ryegrass varieties are quick to establish in newly seeded areas and will crowd out germinating weeds. Kentucky bluegrass, although slow to establish, is very competitive once established.

Mechanical removal of weeds can be very effective if weed populations are not too high. Weeds can be removed by hand or pulling with a knife or V-shaped spudding tool. There are many new non-selective weed control tools on the market that use steam, hot water, super-heated water, propane flammers, etcetera. There is limited research on the level of control of these new non-selective weed control tools. Try in a small area to determine their effectiveness. Be aware of applicator safety.

Chemical Weed Control

The following herbicide information is for use on sod farms, golf courses, turf used for lawn bowling, cricket, lawn tennis and croquet, and for sports fields hosting national or international tournaments.

Chemical weed control is often the easiest, most effective and cheapest way to control annual and perennial weeds when populations are very high.

New Turf

After seeding new turf, many annual weeds may emerge before the grass seedlings. If these young weeds are not controlled, they will shade and eventually crowd out much of the grass population. Mowing at a height of 6–8 cm will eliminate many such weeds. If they are extremely thick, 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) or mecoprop-P (0.4–0.6 kg in 400 L water/ha) can be used but not before the grass has been up at least 4 weeks.

Established Turf

Applications of 2,4-D are most effective in the spring or in September when the weeds are growing well. This treatment generally thins clover. Weeds not normally controlled by 2,4-D may be controlled by mecoprop, or dicamba, or with combinations of one of these with 2,4-D. Mecoprop and dicamba are also sold in

commercial mixtures with 2,4-D. See Table 18-2. *Classification of Weeds According to Response to Various Foliage Sprays*, page 335, for information on the response of common weeds to various herbicides. Thorough wetting of the weed foliage is important.

Do NOT use mixtures containing dicamba close to shrubs, or other susceptible ornamentals at rates above 0.425 kg/ha (active). Prepared mixtures of this chemical and 2,4-D are effective on a wide range of turf weed species, including knotweed, which is not controlled by most other herbicides except when very young.

Broadleaf Herbicides

2,4-D controls many broadleaf weeds including dandelion, plantains, shepherd's purse, smartweeds and vetch.

Mecoprop controls many 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground ivy and black medick, and is generally safer to use on bentgrass than 2,4-D.

Dicamba controls broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clover and young knotweed but does not adequately control plantains.

MCPA controls dandelion, plantains and shepherd's purse. Weeds tolerant to MCPA include chickweeds, clovers and black medick. Two and three-way mixes of these herbicides extend the spectrum of weeds that are controlled compared to only one of these herbicides.

Grass Herbicides

BETASAN, DIMENSION and corn gluten meal based products can be applied before crabgrass emerges in the spring, and ACCLAIM SUPER and DIMENSION can be applied after emergence. Corn gluten meal based products can also be applied in the fall.

Herbicide Application Timings

Site Preparation or Preplant (PP) Treatments

Preplant treatments are applied before the turf is sown or planted. Also see *Preplant Weed Control, Preplant Site Preparation Prior To Any Crop* on page 81 for details of products, rates and remarks.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. These materials prevent emergence of many weed seedlings without reducing turf stand. Apply immediately after seeding or at least before the emergence of the turf.

Postemergence (POST)

Herbicides are applied after the turf seeds have sprouted. Applied as directed, the weeds can be killed without injury to the turf. It is important to apply herbicides to weeds at their most susceptible stage. Smaller weeds are generally easier to kill but enough leaf surface is needed to intercept the required amount of herbicide.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Crop tolerance ratings are: E – Excellent, G – Good, F – Fair, P – Poor. Under unfavourable conditions (e.g. too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Ratings in **BOLD** indicate the weed is listed on the product label for control or suppression. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 17-1. Turfgrass Herbicide Weed Control Ratings

Trade Name	crabgrass	bentgrass	bluegrass, annual	chickweed, common	black medick	chickweed, mouse-eared	clover, white	dandelion	ground-ivy (creeping-charlie)	knotweed	mallow	nutsedge, yellow	plantains	quackgrass
Soil Applied Grass Herbicides														
BETASAN	9	-	3	-	-	-	-	-	-	-	-	-	-	-
DACTHAL W75	8	-	-	8	-	8	-	7	-	-	-	0	0	0
DIMENSION	9	-	-	-	-	-	-	-	-	-	-	-	-	-
Postemergence Grass Herbicides														
ACCLAIM SUPER	9	-	-	-	-	-	-	-	-	-	-	-	-	-
DIMENSION	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Postemergence Broadleaf Herbicides														
2,4-D*	-	-	-	3	5	3	3	9	3	4	4	-	9	-
2,4-D/dicamba/mecoprop-P*	-	-	-	8	8	8	8	9	6	7	6	-	9	-
BASAGRAN	-	-	-	-	-	-	-	-	-	-	-	8	-	-
glyphosate*	9	9	-	9	-	9	-	8	-	-	-	-	-	9
MCPA AMINE	-	-	-	4	4	3	3	6	3	3	3	-	9	-
MECOPROP, COMPITOX	-	-	-	8	8	8	8	6	7	3	3	-	6	-
mecoprop-P/2,4-D*	-	-	-	8	8	7	8	9	2	3	3	-	9	-
SARRITOR	-	-	-	-	2	-	7	7	-	3	-	4	7	-
VANQUISH	-	-	-	8	6	8	8	9	8	8	6	-	4	-
Postemergence Tank-Mixes														
2,4-D* + mecoprop-P*	-	-	-	8	8	7	8	9	2	3	3	-	9	-

* Various formulations available, see Table 4-1. *Herbicides Used in Ontario*, page 23. Not all formulations are registered on turf. See the label for specific uses and rates.

- Insufficient information available to make a rating.

BOLD numbers indicate the weed is listed on the product label for control or suppression.

TRADE NAME
(Concentration)
active ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

RATE PRODUCT
PER ACRE

PRECAUTIONS
(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23
and Chapter 5, *Notes on Adjuvants*, page 69).

GOLF COURSES, SOD FARMS AND OTHER ACCEPTED USES

Preplant Herbicide

Apply in 200–300 L/ha (80–120 L/ac) water.

glyphosate (360 g/L)*	0.75–12 L/ha	0.3–4.8 L/ac
or glyphosate (480 g/L)*	0.56–9 L/ha	0.22–3.6 L/ac
or glyphosate (500 g/L)*	0.54–8.64 L/ha	0.22–3.5 L/ac
or glyphosate (540 g/L) *	0.5–8 L/ha	0.2–3.2 L/ac
glyphosate*	0.27–4.32 kg/ha	

- Glyphosate is a **non-selective herbicide that will kill turf that is sprayed.**
- For actively growing weeds in the fall, or spring prior to planting (otherwise turf will be killed).
- Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds.
- Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later.
- Repeat application to regrowth may be necessary for complete control.
- For specific information on product rate and notes for annual and perennial weed control, refer to Table 4-3. *Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops*, page 60.

Preemergence Grass Herbicides

Apply in 800–1000 L/ha (320–400 L/ac) water, unless otherwise stated.

BETASAN (480 g/L)	23–30 L/ha	9.2–12 L/ac
or BETASAN (GR) (12.5 Gr)	125 kg/ha	50 kg/ac
bensulide	11–14.4 kg/ha	
DACTHAL W-75 (75 WP)	15.5 kg/ha	6.2 kg/ac
chlorthal dimethyl	11.625 kg/ha	
DIMENSION (124 g/L)	3.5 L/ha	1.4 L/ac
Dithiopyr	0.42 kg/ha	

- PRE – Apply to established turf before crabgrass emergence in early spring, or in fall.
- Use the low rate for crabgrass and the high rate for annual bluegrass.
- **Do NOT** reseed the area for 1 year following treatment.
- **Do NOT** apply peatmoss to turf before application.
- Use **ONLY** on mineral soils.
- PRE – Apply early in spring before weed seed germination.
- Apply in 450–1,100 L/ha (180–440 L/ac) water.
- **Do NOT** apply to Cohansey and Toronto bent.
- **Do NOT** re-seed for 60 days after application.
- PRE – Apply in established turf before crabgrass emergence.
- See POST application below.
- Apply in 200–800 L/ha (80–160 L/ac) water.
- Allow turf to recover from aeration, or other stresses before application.
- **Do NOT** apply to putting greens during the first year of establishment.
- Check label for sensitive varieties, including Colonial bentgrasses.
- **Do NOT** irrigate within 2 hours of application.
- **Do NOT** reseed for 3 months after application.
- May be tank-mixed with KILLEX or other broadleaf herbicides.
- **Do NOT** tank-mix with other products for application to putting greens.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.

TRADE NAME (Concentration)	PRODUCT RATE PER HECTARE	RATE PRODUCT PER ACRE	PRECAUTIONS
active ingredient	active rate per ha		(For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).

Inhibitors of Smooth Crabgrass and Dandelion Seed Germination

NUTRITE PRE-EMERGENT, CRABGRASS WEED SEED GERMINATION INHIBITOR (100% corn gluten meal)	980 kg/ha or 9.8 kg/100 m ²	392 kg/ac or 20 lbs/1,000 sq. ft.	• The product may inhibit dandelion and smooth crabgrass weed seed germination when used in conjunction with a sound turf maintenance program. • This product will not control emerged or established dandelion or smooth crabgrass. • PRE – Apply to established turf twice each year; once in early spring and once in late summer or early fall to sports fields, parks, golf areas and sod farms. • Apply using a rotary or small hand spreader. • Spring application: two weeks before large crabgrass seed germination. • Late summer or early fall: after heat stress has passed. • Apply to a mature turf where established perennial ryegrass is the predominant species. • Do NOT apply on newly seeded grass, wait until after first mowing. • Do NOT apply under windy conditions. • Do NOT apply in the spring if overseeding or resodding in the spring. • Do NOT apply in the fall if overseeding or resodding in the fall. • Do NOT apply if allergic to corn.
TURFMAIZE PRE-EMERGENT WEED SEED GERMINATION INHIBITOR (98% corn gluten meal)	970 kg/ha or 9.7 kg/100 m ²	388 kg/ac or 20 lbs/1,000 sq. ft.	• The product may inhibit dandelion and smooth crabgrass weed seed germination when used in conjunction with a sound turf maintenance program. • This product will not control emerged or established dandelion or smooth crabgrass. • PRE – Apply to Kentucky bluegrass turf twice a year: once in the early spring and once in the late summer/early fall. • Apply using a rotary or small hand spreader. • Spring application: apply to established Kentucky bluegrass turf in early spring before smooth crabgrass and dandelion seed germination. • Late summer/early fall: Apply to established Kentucky bluegrass turf in late summer or early fall after heat stress has passed. • Apply when soil is moist and rain is forecasted within 2 days of treatment. • If rainfall does not occur within 2 days of treatment, irrigation is required. • Excessive moisture at time of treatment may reduce the effectiveness. • Do NOT apply on newly seeded grass, wait until after first mowing. • Do NOT apply in the spring if overseeding or resodding in the spring. • Do NOT apply in the fall if overseeding or resodding in the fall. • Do NOT apply if allergic to corn.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Postemergence Grass Herbicides			
Apply in 400–800 L/ha (160–320 L/ac) water.			
ACCLAIM SUPER (80.5 g/L) <i>fenoxaprop-p-ethyl</i>	1.14 L/ha 0.092 kg/ha	0.46 L/ac	• POST – For the control of crabgrass at the 1–4 leaf up to the multi-tiller stage. • Good coverage is essential to control multi-tillered or grassy weeds in the reproductive phase. • Make a second application on mature monostands 21 days after first application. • Do NOT apply to bentgrass or seedling Kentucky bluegrass. • Do NOT tank-mix with any other herbicide or pesticide. • Do NOT apply broadleaf herbicides 7 days before or after ACCLAIM SUPER. • Do NOT apply during periods of drought stress. • Do NOT mow grass for 4 days before or after application. • Do NOT irrigate within 3 hours after application.
DIMENSION (124 g/L) <i>Dithiopyr</i>	3.5–4.5 L/ha 0.42–0.54 kg/ha	1.4–1.8 L/ac	• POST – For established turf until crabgrass reaches the 1–3 leaf stage before tillering; NOT recommended after 3 leaf stage. See PRE application above. • Use higher rate for larger plants or when area is heavily infested. • Apply in 200–800 L/ha (80–160 L/ac) water. • Allow turf to recover from aeration, or other stresses before application. • Do NOT apply to putting greens during the first year of establishment. • Check label for sensitive varieties, including Colonial bentgrasses. • Do NOT irrigate within 2 hours of application. • Do NOT reseed for 3 months after application. • May be tank-mixed with KILLEX or other broadleaf herbicides. • Do NOT tank-mix with other products for application to putting greens.
Postemergence Broadleaf Herbicides			
Apply in 200–400 L/ha (80–160 L/ac) water. Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. DO NOT irrigate, rake, and/or mow until at least 24 hours after application. DO NOT apply to newly seeded turf until after second mowing.			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	1.7–3 L/ha 1.42–2.48 L/ha 1.2–2.1 L/ha	0.68–1.2 L/ac 0.57–1 L/ac 0.48–0.84 L/ac	• To control many broadleaf weeds including dandelion, lamb's-quarters, mustards, peppergrass, pigweeds, plantains, shepherd's-purse, smartweeds, and vetch. • Damage may occur when applied to bentgrass. • If used on bentgrass apply at 0.28 kg a.i./ha. Some yellowing of bentgrass may occur.
2,4-D*	0.8–1.4 kg/ha		
2,4-D/dicamba/mecoprop-P (308 g/L)*	5.5 L/ha	2.2 L/ac	• To control 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground ivy and black medick as well as many broadleaf weeds including dandelion, lamb's-quarters, mustards, peppergrass, pigweeds, plantains, shepherd's-purse, smartweeds, and vetch. • In closely mowed bentgrass (greens) apply at half doses (30 mL/100 m²). • Temporary yellowing of bentgrass may occur. • Recovery from injury will occur 1 week after application. • See precautions for VANQUISH, page 316.
2,4-D/ dicamba/ mecoprop-P*	1.7 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)* plus MECOPROP (150 g/L)	1.81–2.34 L/ha 1.51–1.95 L/ha 1.29–1.67 L/ha 5.67–7.34 L/ha	0.72–0.93 L/ac 0.6–0.78 L/ac 0.52–0.67 L/ac 2.27–2.93 L/ac	• May be combined with VANQUISH (0.21 L/ha (0.08 L/ac)) for control of young knotweed. • Damage may occur when applied to bentgrass. • For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) or mecoprop-P (0.4–0.6 kg in 400 L water/ha) for annual weeds.
2,4-D* plus mecoprop-P	0.85–1.1 kg/ha 0.85–1.1 kg/ha		
BASAGRAN (480 g/L) plus ASSIST	1.75 L/ha 2 L/ha	0.7 L/ac 0.8 L/ac	• To control top growth of yellow nutsedge. Apply when nutsedge is young and actively growing. Make 2 applications 10 days apart. • Do NOT mow grass 3–5 days before and after application. • Do NOT treat newly seeded turf until well established.
bentazon plus oil concentrate	0.84 kg/ha		
COMPITOX (150 g/L) or MECOPROP (150 g/L)	5.5–8.5 L/ha	2.2–3.4 L/ac	• To control 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground ivy and black medick, as well as many broadleaf weeds. • May be applied to bentgrass. • Apply to dandelion prior to flowering. • Repeated applications may be needed for dandelion and black medick.
mecoprop-P	0.83–1.28 kg/ha		
IPCO PREMIUM 2-WAY XP TURF HERBICIDE ((1:1) 400 g/L)	5 L/ha	2 L/ha	• May be combined with VANQUISH (0.21 L/ha (0.08 L/ac)) for control of young knotweed. • Damage may occur when applied to bentgrass. • For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) or mecoprop (0.4–0.6 kg in 400 L water/ha) for annual weeds.
mecoprop-P/2,4-D	2 kg/ha		
MCPA AMINE (500 g/L)*	2.2–2.8 L/ha	0.88–1.12 L/ac	• For control of field horsetail, dandelion, lamb's-quarters, mustards, plantains, shepherd's-purse, and wild carrot. • Do NOT apply to bentgrass unless necessary, and then only at 0.28 kg/ha. Some yellowing of bentgrass may occur. • Use as a substitute for 2,4-D. At slightly higher doses than 2,4-D it usually provides comparable weed control to 2,4-D. • Reduced control of dandelion and plantain may occur during dry, hot weather.
MCPA*	1.1–1.4 kg/ha		
MECOTURF PLUS 2,4-D ((1:1) 400 g/L)	4.25–5.5 L/ha	1.7–2.2 L/ac	• May be combined with VANQUISH (0.21 L/ha (0.08 L/ac)) for control of young knotweed. • Damage may occur when applied to bentgrass. • For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) or mecoprop-P (0.4–0.6 kg in 400 L water/ha) for annual weeds.
mecoprop-P/2,4-D	1.7–2.2 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	RATE PRODUCT PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
SARRITOR <i>Sclerotinia minor</i> (strain IMI 344141)	40–60 g/m ²		• For suppression of dandelion and other broadleaf weeds. • Apply when daytime high temperatures are 18–24°C and rainfall occurs within 12 hours of application. • Use higher rate when environmental conditions are sub-optimal or when dandelion pressure is high. • Do NOT mow for 3 days after application. • Do NOT allow SARRITOR to come in contact with non-target, desirable plant species as severe damage may occur.
VANQUISH (480 g/L) <i>dicamba</i>	1.25 L/ha 0.6 kg/ha	0.5 L/ac	• Do NOT apply to bentgrass. • Do NOT apply near shallow rooted perennials to avoid root uptake and injury. • To control broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clover and young knotweed, but will not adequately control plantain. • Prepared mixtures of VANQUISH and 2,4-D are effective on a wide range of turf weed species, including knotweed, which is not controlled by most other herbicides except when very young. • Do NOT use mixtures containing VANQUISH close to shrubs, or other susceptible ornamentals, at rates above 0.425 kg/ha (active). • Do NOT mow grass 3–5 days before and after application. • Do NOT treat newly seeded turf until well established.
Renovation			
Mow and thoroughly rake the turf to be renovated to remove all dead and cut vegetation.			
glyphosate (360 g/L)*	4.75–7 L/ha	1.9–2.8 L/ac	• Apply in 200–300 L/ha (80–120 L/ac) water after omitting at least 1 regular mowing. • Ideally delay tillage 7 days after application to allow for proper translocation into underground plant parts. • Direct seeding into the killed turf (no tillage) may be carried out.
or glyphosate (480 g/L)*	3.54–5.2 L/ha	1.42–2.1 L/ha	
or glyphosate (500 g/L)*	3.4–5 L/ha	1.36–2 L/ha	
or glyphosate (540 g/L)*	3.15–4.6 L/ha	1.26–1.84 L/ha	
glyphosate*	1.7–2.5 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.



18. ROADSIDES & NON-CROP AREAS

ROADSIDES, RIGHTS-OF-WAY, FENCEROWS AND NON-CROP AREAS

Fencerows and Farm Areas

In agricultural areas, weeds growing in fencerows, around buildings and on roadsides are sources of potential weed infestation to other parts of a farm. In addition, brush and weeds around fields harbor insects, diseases and other pests that may be detrimental to farming operations. Shrubs like wild cherry may be possible sources of live-stock poisoning.

Farmers may also wish to reclaim land on which willows or brush have encroached. It is important to keep drainage ditches and farm ponds free of troublesome aquatic vegetation (refer to Chapter 19. *Water Weeds (Aquatic Plants)*, page 339).

Roadsides, Rights-of-Way and Waste Places

Under exceptions to the cosmetic pesticides ban, class 9 pesticides can be used in situations related to the promotion of public health or safety. O. Reg. 63/09 defines "the promotion of public safety or health" to include "the destruction, prevention, or control of plants, fungi or animals that affect public works or other buildings and structures". Public work is defined in the regulation, and means a structure that provides a benefit to the public and that is owned or operated by the Government of Ontario or Canada or by any board or commission thereof, or by any municipal corporation, public utility commission or by private enterprise and includes:

- Any railway, canal, highway, bridge, power works including all property used for the generation, transformation, transmission, distribution or supply of hydraulic or electrical power, gas works, water works, public utility or other work.

Class 9 pesticides can be used in an extermination related to public works only for the following:

- To prevent structural damage to a public work, if the potential damage to the public work caused by the pest would place the health or safety of a person at risk.
- For essential maintenance of the public work, if the pest would interfere with or prevent the essential maintenance.
- To allow for emergency access to the public work.
- To ensure the security of the public work if the pest would place the security at risk (e.g. vegetation-free security perimeters at power generating facilities).
- To prevent damage to the structural integrity of a building or other structure that is not part of a public work, if the potential damage caused to the building or structure by the pest could place the health or safety of a person at risk.

Ontario's cosmetic pesticides ban came into effect April 22, 2009. The requirements of the ban are detailed in Ontario Regulation 63/09 under the *Pesticides Act*.

Uses of class 9 pesticides for agricultural purposes is excepted from the cosmetic pesticides ban. Farmers are not excepted from the cosmetic pesticides ban when using pesticides for maintaining lawns and gardens around the farm house, which are not part of an agricultural operation.

The use of pesticides for the above mentioned applications does not include the use of class 9 pesticides along portions of highways that are accessed by pedestrians on a regular basis or other portions where the public is invited to stop, including a rest area or picnic area.

Commencing April 22, 2010, class 9 pesticides used in an extermination with respect to a public work must be applied by an appropriately licensed exterminator who is certified by a integrated pest management (IPM) body or licensed exterminator working under written instructions of a person who is certified by an IPM body.

The owner or operator of the public work is responsible for ensuring an annual report is prepared that summarizes all pesticide used.

Both railway and power supply authorities are concerned with maintaining safe and accessible rights-of-way by controlling growth of weeds and brush.

In certain areas (beneath guide rails, in storage yards, under railway tracks and under fences at road intersections), it may be advantageous to completely kill all vegetation for long-term control. Consider vegetation control measures such as mechanical (e.g. cutting or mowing) and cultural practices (e.g. seeding desirable species) as an alternative to herbicides. Herbicides and suggestions for their use in this way can be found in *Vegetation Control - Long Term Non-selective*, page 330.

Precautions should always be taken to minimize herbicide drift in roadside and right-of-way vegetation management. It is advisable to inspect or monitor each roadside just prior to spraying to locate susceptible crops, water crossings, portions of highways that are accessed by pedestrians on a regular basis or other portions where the public is invited to stop, and other sensitive areas. Appropriate "shut off" and "turn on" points should be marked so these areas can be avoided during the actual spray operation.

BRUSH CONTROL

There are several techniques that may be used for the chemical control of deciduous woody species: stem foliage sprays, basal bark sprays and frilling or spot treatments.

The choice of technique will depend on such factors as brush type, accessibility, availability of equipment, proximity to susceptible crops or ornamental vegetation and the size of the control program.

Stem Foliage Treatments Applied to "Runoff" – Most Deciduous Woody Species

Stem foliage treatment of brush should be limited to smaller growth (less than 2 m in height). Treatments should be applied to thoroughly wet the stems and foliage to the point of runoff. This technique is most effective just after full leaf development in late spring or early summer.

The choice of herbicides for controlling stands of deciduous brush should be based on the susceptibilities of the predominant species (Table 18-1. *Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays*, on page 333) or whether the brush to be controlled is near homes, recreational areas, etc.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	3.6–9 L/1,000 L 3–8.5 L/1,000 L 2.6–7.3L/1,000 L		• One application may be sufficient for sensitive species. • For intermediately sensitive species, repeated treatments are normally required.
2,4-D*	1.7–4.8 kg/1,000 L		
DIPHENOPROP BK 700 (679 g/L) or DESORMONE (680 g/L) or ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP 600 (582 g/L)	7.5–10 L/1,000 L 7.5–10 L/1,000 L 8.75–11.7 L/1,000 L 8.75–11.7 L/1,000 L 8–11 L/1,000 L		• Apply the low-volatile ester in areas dominated by species expected to be tolerant to 2,4-D alone.
dichlorprop/2,4-D	5.1–6.8 kg/1,000 L		
GARLON 4 (480 g/L)	4–8 L/1,000 L		• Apply to the point of run-off when the brush is actively growing. • Use the higher rate for the more difficult to control species.
triclopyr	1.92–3.84 kg/1,000 L		
glyphosate (360 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	10–20 L/1,000 L 7.5–15 L/1,000 L 7.2–14.4 L/1,000 L 6.67–13.3 L/1,000 L		• Most woody and herbaceous species. Can be applied during June, July or August. • Injury to grasses will occur; use other selective products if grasses are to be maintained.
glyphosate*	3.6–7.2 kg/1,000 L		
KRENITE (480 g/L)	10–15 L/1,000 L		• For oak, maple, alder, hickory and ash. • Additional surfactants may be required for difficult species.
fosamine ammonium	4.81–7.21 kg/1,000 L		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
TORDON 101((1:3.7)305 g/L) <i>picloram</i> /2,4-D	10 L/1,000 L 3.05 kg/1,000 L		• Excluding white ash. • Apply to wet the stems and foliage to the point of runoff when the leaves are fully expanded. • A permit for purchase and use is required.
VANQUISH (480 g/L) or ORACLE (480 g/L) plus 2,4-D (470 g/L)*	4 L/1,000 L 8 L/1,000 L		• Apply to the point of runoff when the leaves are fully expanded.
<i>dicamba</i> plus 2,4-D*	1.9 kg/1,000 L 3.8 kg/1,000 L		
VANQUISH (480 g/L) or ORACLE (480 g/L) plus DIPHENOPROP BK 700 (679 g/L) or DESORMONE (680 g/L)	5.2 L/1,000 L 7.15 L/1,000 L		• For white ash and sugar maple. • Apply to the point of runoff when leaves are fully expanded.
<i>dicamba</i> plus <i>dichlorprop</i> /2,4-D	2.5 kg/1,000 L 4.9 kg/1,000 L		
Constant Volume Follar Applications – Most Deciduous Woody Species (excluding white ash)			
For Brush Control on Roadsides and Other Rights-of-Way			
ARSENAL (240 g/L) <i>imazapyr</i>	3 L/ha 0.72 kg/ha	1.2 L/ac	• For maple, poplar, raspberry, and wildrose. • Apply in sufficient water (100–550 L/ha) (40–220 L/ac) to wet all foliage during periods of active growth.
DIPHENOPROP BK 700 (679 g/L) or ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP 600 (582 g/L)	5.5–15 L/ha 6.5–17.5 L/ha	2.2–6 L/ac 2.6–7 L/ac	• Apply in 750–1500 L/ha water (300–600 L/ac) during periods of active growth. • Rate of mixture depends on brush density or height.
<i>dichlorprop</i> /2,4-D	3.8–10.2 kg/ha		
GARLON 4 (480 g/L) <i>triclopyr</i>	4–8 L/ha 1.92–3.84 kg/ha	1.6–3.2 L/ac	• Apply this low volatile ester in a minimum of 200 L/ha water (80 L/ac) during periods of active growth.
TORDON 101 ((1:3.7)305 g/L) <i>picloram</i> /2,4-D	18–25 L/ha 5.49–7.62 kg/ha	7.2–10 L/ac	• Apply in 450 L/ha water (180 L/ac) during the active growing season. • Use an approved drift control system or additive. • A permit for purchase and use is required.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
VANQUISH (480 g/L) or ORACLE (480 g/L) plus 2,4-D (470 g/L)*	4.2 L/ha 8 L/ha	1.7 L/ac 3.2 L/ac	• Apply in sufficient water (220–330 L/ha) (88–132 L/ac) to wet all foliage. • Amine or ester formulations of 2,4-D may be used.
dicamba plus 2,4-D*	2 kg/ha 3.8 kg/ha		
VANQUISH (480 g/L) or ORACLE (480 g/L) plus DIPHENOPROP BK 700 (679 g/L)	5.2 L/ha 7.2 L/ha	2.1 L/ac 2.9 L/ac	• Apply in sufficient water (200–330 L/ha) (80–132 L/ac) to wet all foliage.
dicamba plus dichlorprop/ 2,4-D	2.5 kg/ha 4.9 kg/ha		

Basal-Bark Treatments in Oil as a Carrier

The BASAL-BARK treatment is useful on a wide range of trees and brush with a trunk diameter up to about 15 cm. Apply the chemical so as to thoroughly cover the basal 30 cm of the trunk and any exposed roots. For oak, hickory, basswood or ash, treatments are most effective from February to June. Most other species may be treated at any season of the year.

Light, simple equipment, coupled with the possibility of winter operations when labor is cheaper and access to swampy areas possible, give this treatment an important role in a brush control program.

2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	6.4 L/100 L 5.3 L/100 L 4.55 L/100 L	• For hawthorn. Use the low-volatile ester formulations in fuel oil.
2,4-D*	3 kg/100 L	
DIPHENOPROP BK 700 (679 g/L) or DESORMONE (680 g/L) or ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP 600 (582 g/L)	2.8–4.4 L/100 L 2.8–4.4 L/100 L 3.2–5.2 L/100 L 2.3 L/100 L 2.4–3.2 L/100 L	• For most woody species, including conifers. • Use the low-volatile ester formulations in fuel oil. • Spray bark to wet only.
dichlorprop/2,4-D	1.9–3 kg/100 L	

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
GARLON 4 (480 g/L)	20–30 L/100 L		• For most woody species, not including conifers.
<i>triclopyr</i>	9.6–14.4 kg/100 L		• Apply a 20%–30% solution mixed in mineral or vegetable oil.
			• One Sided Low Volume – This low volume treatment can be applied to stems less than 15 cm in diameter. Apply the spray to thoroughly wet at least one side of the stem and root crown but not to the point of run-off.
			• Streamline – Apply sufficient spray to one side of stems less than 8 cm in basal diameter to form a band that is 5 cm in width. The treatment zone should widen to encircle the stem within 30 minutes. Treat both sides of stems which are 8–12 cm in basal diameter.

Stump Treatment After Cutting to Most Deciduous Woody Species

In many cases, it is more desirable to remove existing brush by hand than to spray it and leave the dead material standing. Chemical stump treatment is particularly useful in preventing the vigorous regrowth that is the characteristic response of many deciduous species after cutting. Moreover killing the stump is the first step towards encouraging it to rot.

Most treatments must be applied to freshly cut stumps to achieve maximum effectiveness. For old stumps, it is best to drill several holes or to split stump with a wedge before applying the treatments. Spray regrowth from an old stump along with the stump. Various dye materials may be added to the oil based sprays to assure that all exposed surfaces of the stumps are treated.

2,4-D (470 g/L)*	4.25 L/100 L	• Apply in oil as a carrier.
or 2,4-D (564 g/L)*	3.55 L/100 L	• Apply in diesel fuel to run-off.
or 2,4-D (660 g/L)*	3 L/100 L	
2,4-D*	2 kg/100 L	
DIPHENOPROP BK 700 (679 g/L)	2.8 L/100 L	• Apply in oil as a carrier.
or DESORMONE (680 g/L)	2.8 L/100 L	
or ESTAPROP (582 g/L)	3.25 L/100 L	
or DICHLORPROP D (582 g/L)	3.25 L/100 L	
or TURBOPROP 600 (582 g/L)	3.25 L/100 L	
<i>dichlorprop/2,4-D</i>	1.9 kg/100 L	
GARLON 4 (480 g/L)	20–30 L/100 L	• Apply in oil as a carrier to cut stump.
<i>triclopyr</i>	9.6–14.4 kg/100 L	• Thoroughly wet all cut surfaces and any exposed bark.
		• Treatment can be performed any time after mechanical removal.
TORDON 101((1:3.7)305 g/L)	10 L/10 L	• Dilute 1:1 with water or 1:1 with ethylene glycol if below freezing.
<i>picloram/2,4-D</i>	3.05 kg/10 L	• A permit for purchase and use is required.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Concentration)
Active Ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4. *Herbicides Used in Ontario*, page 23, and Chapter 5. *Notes on Adjuvants*, page 69).

EVERGREEN OR CONIFER CONTROL

Stem Foliage Treatments with Water as a Carrier – Mixed stands (Conifers and Deciduous)

All of the treatments are applied so as to thoroughly wet all foliage. Use low pressure and apply from 500–1,500 L/ha solution (200–600 L/ac), depending on the amount of foliage. Thorough coverage is particularly important and the addition of a wetting agent will increase effectiveness.

TORDON 101((1:3.7)305 g/L)	10 L/1,000 L		• Apply when the conifers are actively growing in early summer. • Spray should thoroughly wet all plant parts including stem, foliage, and root collar. • Add 0.25% v/v solution of Sylgard 309 surfactant when controlling conifers. • A permit is required for purchase and use.
picloram/2,4-D	3.05 kg/1,000 L		
TORDON 101((1:3.7)305 g/L)	22–25 L/ha	7.2–10 L/ac	• Apply in 450 L/ha (180 L/ac) water as a constant volume foliar application during the period of active conifer growth in early summer. • Add 0.25%–0.375% v/v solution of Sylgard 309 surfactant when controlling conifers. • A permit for purchase and use is required.
picloram/2,4-D	6.71–7.62 kg/ha		
VANQUISH (480 g/L) or ORACLE (480 g/L) plus 2,4-D (470 g/L)*	4 L/1,000 L 8 L/1,000 L		• Apply as amines in early summer. • Thorough coverage is needed.
dicamba plus 2,4-D*	1.9 kg/1,000 L 3.8 kg/1,000 L		
VANQUISH (480 g/L) or ORACLE (480 g/L) plus DIPHENOPROP BK 700 (679 g/L)	5.2 L/1,000 L 7.15 L/1,000 L		• Apply in spring or early summer. • Thorough coverage is needed. • Follow instructions on VANQUISH label for tank-mix.
or DESORMONE (680 g/L)	7.15 L/1,000 L		
dicamba plus dichlorprop/2,4-D	2.5 kg/1,000 L 4.9 kg/1,000 L		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Concentration)
Active Ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

GENERAL TREATMENTS FOR WOODY SPECIES

Single or scattered trees or shrubs may be controlled efficiently with dry applications of sodium borate or chlorate mixtures. Apply the chemical in a band at the base of the plant, following the manufacturer's directions.

Basal (Spot) Treatment

On stands of deciduous or coniferous brush that range from light to scattered, use individual spot treatment with bromacil (HYVAR X-L). It may be applied with an exact delivery hand gun. Apply undiluted at 10 g/m of height (5 cm diameter) or brush or dilute 1 HYVAR X-L with 5 L of water and apply 60 g/m of height of brush. Taller and larger brush requires progressively more herbicide.

Sucker Growth Control After Pruning

Many trees sprout prolifically after they have been pruned. The application of fortified tree wound dressings to the surface of the cuts can reduce the number of new sprouts from many tree species.

These paints improve natural inhibition achieved through the use of poor trimming practice. All pruning should be done to strong laterals. Severe pruning should be avoided. Best results will be obtained if the materials are applied to the cuts between April 15–July 15. Treatment of all cuts is important, as each is a potential location for sprouting from both dormant and adventitious buds. Cover the entire cut and about 2 cm of the surrounding bark, especially below the cut. Heavy tree wound dressing will adversely affect the rate of callus formulation of some species.

Tree Injection

Glyphosate as a 0.15 g EZJECT capsule can be used to control woody brush and trees with an EZJECT capsule injection system. Capsules must penetrate through the outer bark and into the inner living tissue to provide effective results. Capsules should be spaced evenly around the tree, below all major branches at a rate of 1 capsule per 5 cm sem diameter at breast height (dbh). Stems should be in excess of 3 cm dbh but usually not in excess of 20 cm dbh. Trees should not be frozen at time of treatment. Allow 1–2 years for complete control.

PERENNIAL WEED CONTROL (NON-CROP LAND)

CAUTION: Unless otherwise recommended, do not use these treatments in crop situations. Avoid using if the chemical is likely to wash or leach into areas occupied by the roots of desirable trees or other plants. Follow all precautions to avoid spray drift onto non target vegetation.

The use of atrazine, simazine, bromacil, or diuron non selectively, as described, is generally limited by cost to the handling of small patches of perennial weeds. The chemical either leaches down to the weed root system or makes the surface soil toxic for a period of time varying from a few months to several years, depending on the chemical, rate of application and soil type. Generally, crops cannot be grown successfully until the effect of the chemical has disappeared. Corn, however, can be grown safely when high rates of simazine and atrazine are applied.

Some perennial weeds, such as field bindweed, horsetail, goldenrod, milkweed and bracken fern, are difficult to eradicate at the lower rates of diuron, simazine, atrazine and bromacil. Follow the manufacturer's directions carefully if the area is to be re-seeded. The amitrole treatment is of value in spot treating patches of quackgrass in a field that is not entirely infested.

While the tops of many perennial weeds may be controlled by doses of 2,4-D that may be selectively used in resistant crops, heavier doses, as described, must be used if eradication is to be attempted. Several applications upon successive stages of regrowth will probably be necessary. Generally, treatments with 2,4-D during rapid development of the weed at about the early bud to flowering stages of growth are most effective. Apply spray to thoroughly wet all foliage.

Heavier doses of 2,4-D on patches of weeds may be applied during normal selective spraying operations merely by slowing down the sprayer speed in the infested areas. Expect local crop damage where this is done.

Perennial weeds are more difficult to control than annual weeds because regrowth occurs rapidly from underground parts after the top growth is removed by chemical or mechanical means. In non crop land they pose a special problem because cultivation cannot be used for their control. Chemicals must kill the root system as well as the above ground parts to give effective perennial weed control.

Postemergence Grass Herbicides

AMITROL 240 (231 g/L)	12.5–16.5 L/ha	5–6.6 L/ac
amitrole	3–4 kg/ha	

- Apply to actively growing quackgrass foliage when growth is 15–20 cm in height.
- Wait at least 10 days before plowing or disking.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
glyphosate (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	2.35–2.5 L/ha 1.89–2 L/ha 1.77–1.875 L/ha 1.7–1.8 L/ha 1.57–1.67 L/ha	0.94–1 L/ac 0.76–0.8 L/ac 0.71–0.75 L/ac 0.68–0.72 L/ac 0.63–0.67 L/ac	• For a minimum of 1 season control of quackgrass, apply in the fall or spring before planting. • Apply, using flat-fan nozzles, in 50–100 L/ha water (20–40 L/ac). • For use in higher water volumes, the addition of a surfactant such as ENHANCE or LI 700 is recommended.
glyphosate*	0.85–0.9 kg/ha		
KERB (50 WP)	2.2–3.6 kg/ha	0.88–1.44 kg/ac	• Apply in fall from late September to early November but before soil freezes. • Control of weeds other than perennial grasses cannot be expected.
propyzamide	1.1–1.8 kg/ha		
Postemergence Broadleaf Herbicides			
2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2–4.25 L/ha 1.77–3.55 L/ha 1.5–3 L/ha	0.85–1.7 L/ac 0.71–1.42 L/ac 0.6–1.2 L/ac	• Apply in 1,000 L/ha water (400 L/ac). • See Table 18-2. <i>Classification of Weeds According to Response to Various Foliage Sprays</i> , page 335 for list of weed susceptibilities to 2,4-D and related chemicals.
2,4-D*	1–2 kg/ha		
AMITROL 240 (231 g/L)	18.75–28 L/ha	7.5–11.2 L/ac	• For milkweed control. • Apply in 500–1,000 L/ha water (200–400 L/ac) after most shoots have emerged but before flowering.
amitrole	4.5–6.75 kg/ha		
DIPHENOPROP BK 700 (679 g/L) or DESORMONE (680 g/L) or ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP 600 (582 g/L)	3.5 L/ha 3.5 L/ha 4 L/ha 4 L/ha 4 L/ha	1.4 L/ac 1.4 L/ac 1.6 L/ac 1.6 L/ac 1.6 L/ac	• Apply as a low-volatile ester in 200–600 L/ha water (80–240 L/ac) during the month of May or in early fall.
dichlorprop/2,4-D	2.375 kg/ha		
GARLON 4 (480 g/L)	1–4 L/ha	0.4–1.6 L/ac	• Apply in a minimum of 200 L/ha water (80 L/ac) to ensure uniform coverage.
triclopyr	0.48–1.92 kg/ha		
TELAR (75 DF)	120 g/ha	48 g/ac	• For Canada thistle, dandelion, and field horsetail. Add a surfactant to improve control.
chlorsulfuron	90 g/ha		
TORDON 101((1:3.7)305 g/L)	7 L/ha	2.8 L/ac	• For Canada thistle, sweet and red clover, wild carrot, common ragweed, goldenrod, dock, plantain, prickly lettuce, burdock, fleabane and vetch. • Apply in 200 L/ha of water as a constant volume foliar application. • Apply when weeds are actively growing. • Do not allow drift on susceptible vegetation such as beans, peas, vegetable crops, gardens or shelterbelts. • A permit is required for purchase and use.
picloram/2,4-D	2.135 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
TRANSLINE (360 g/L) <i>clopyralid</i>	0.42–0.83 L/ha 0.15–0.3 kg/ha	0.17–0.33 L/ac	• For coltsfoot, spotted knapweed, ragweed, Canada thistle, ox-eye daisy, tufted vetch, scentless chamomile and clover. • Treat when weeds are young and actively growing. • For coltsfoot, treatments should be performed prior to August. • Apply as a broadcast in 200 L/ha water (80 L/ac) or in sufficient water to ensure thorough coverage of target vegetation.
VANQUISH (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	2.3 L/ha 1.108 kg/ha	0.92 L/ac	• For field bindweed, leafy spurge and cypress spurge. • Apply sprays in mid June or during flowering, in 100–200 L/ha water (40–80 L/ac). Canada thistle or perennial sow-thistle. • Apply spray in late spring just prior to flowering, or apply to regrowth escaping other treatments, in summer or fall.
Postemergence Grass and Broadleaf Herbicides			
ARSENAL (240 g/L) <i>imazapyr</i>	3 L/ha 0.72 kg/ha	1.2 L/ac	• Apply in sufficient water (100–550 L/ha or 40–220 L/ac) to wet all foliage during periods of active growth.
CASORON 4G (4 Gr) <i>dichlobenil</i>	275–550 kg/ha 11–22 kg/ha	110–220 kg/ac	• To use as a split application, apply CASORON 4G at 150 kg/ha (60 kg/ac) in the fall and again at 150 kg/ha (60 kg/ac) in early spring.
DIUREX BOWDG <i>diuron</i>	11–27.5 kg/ha 8.8–22 kg/ha	4.4–11 kg/ac	• Apply this rate on sands and sandy loam soils.
DIUREX 8OWDG <i>diuron</i>	40–55 kg/ha 32–44 kg/ha	16–22 kg/ac	• Apply this rate on clays or high organic soils.
glyphosate (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)*	7–12 L/ha 5.6–9.6 L/ha 5.25–9 L/ha 5–8.64 L/ha 4.67–8 L/ha	2.8–4.8 L/ac 2.24–3.84 L/ac 2.1–3.6 L/ac 2–3.46 L/ac 1.87–3.2 L/ac	• Apply 200–300 L/ha water (80–120 L/ac) when field bindweed has reached full flower, and Canada thistle and milkweed have reached the bud to bloom stage.
glyphosate* HYVAR X-L (240 g/L) <i>bromacil</i>	2.52–4.32 kg/ha 30–45 L/ha 7.2–10.8 kg/ha	 12–18 L/ac	
KARMEX (80 DF) <i>diuron</i>	14–55 kg/ha 11.2–44 kg/ha	5.6–22 kg/ac	• Apply in 1,000 L/ha water (400 L/ac).

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
KROVAR ((1:1)80 DF)	13.5–18 kg/ha	5.4–7.2 kg/ac	
<i>bromacil/ diuron</i>	10.8–14.4 kg/ha		
MILESTONE (240 g/L)	0.25–0.5 L/ha	0.10–0.20 L/ac	• Apply Postemergence. • Will control: absinth (biennial) wormwood, goldenrod, knapweed, scentless chamomile, Canada thistle, yellow star thistle, musk (nodding) thistle, sulphur cinquefoil and tropical soda apple. • Will suppress: common tansy and dandelion.
<i>aminopyralid</i>	60–120 g/ha		
MILESTONE (240 g/L) + 2,4-D Amine (564 g/L)*	0.25–0.5 L/ha 1.49–2.55 L/ha	0.10–0.20 L/ac 0.596–1.02 L/ac	• Apply Postemergence. • For wider spectrum of weed control, 2,4-D amine may be added at a ratio of 1 part MILESTONE ai/ha to 12 parts 2,4-D amine ai/ha.
<i>aminopyralid plus 2,4-D Amine*</i>	60–120 g/ha 840–1440 g/ha		
TORDON 101((1:3.7)305 g/L)	7 L/ha	2.8 L/ac	• Apply in 200 L/ha water (80 L/ac) during spring or early summer after growth appears. • Use an approved drift control additive or system.
<i>picloram/2,4-D</i>	2.134 kg/ha		• A permit is required for purchase and use.

POISON-IVY CONTROL

Several chemicals have been shown to be effective for the control of poison-ivy. However, some growth may occur after treatment with any of these chemicals and retreatments will be necessary to achieve eradication. The chemical treatment of poison-ivy must take into account the location in which the weed is growing. If desirable shrubs or trees are present, avoid soil sterilants and use the other materials with caution.

A 9–14 L sprayer is the most convenient method of applying herbicides to patches of poison-ivy. Thorough coverage of the leaves with the spray is essential for maximum effect. After spraying, leave the area alone until the plants die, at which time gather and bury the dead stems. Even at this stage poisoning may be brought about by handling the dead plant. All treatments are most effective when the poison-ivy is in full leaf and growing actively, from about June 15–July 31.

Postemergence

AMITROL 240 (231 g/L)	9.25 L/ha	3.7 L/ac	• Apply in at least 1,000 L/ha water (400 L/ac) when plants are actively growing. Thoroughly wet all foliage.
<i>amitrole</i>	2.25 kg/ha		
ARSENAL (240 g/L)	3 L/ha	1.2 L/ac	• Apply in sufficient water (100–550 L/ha (40–220 L/ac)) to wet all foliage during periods of active growth.
<i>imazapyr</i>	0.72 kg/ha		
DIPHENOPROP BK 700 (679 g/L) or ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP 600 (582 g/L)	10 L/1,000 L 11.7 L/1,000 L 11.7 L/1,000 L 11 L/1,000 L		• Apply spray until foliage is thoroughly wet.
<i>dichlorprop/2,4-D</i>	6.8 kg/1,000 L		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
GARLON 4 (480 g/L)	4–6 L/ha	1.6–2.4 L/ac	• Use a minimum of 200 L/ha (80 L/ac) of spray solution to ensure thorough coverage.
<i>triclopyr</i>	1.92–2.88 kg/ha		
glyphosate (360 g/L)*	7–12 L/ha	2.8–4.8 L/ac	• Apply to actively growing plants in 200–300 L/ha water (80–120 L/ac) to thoroughly wet the foliage but do not spray to the point of runoff.
or glyphosate (450 g/L)*	5.6–9.6 L/ha	2.24–3.84 L/ac	
or glyphosate (480 g/L)*	5.25–9 L/ha	2.1–3.6 L/ac	
or glyphosate (500 g/L)*	5–8.64 L/ha	2–3.46 L/ac	
or glyphosate (540 g/L)*	4.67–8 L/ha	1.87–3.2 L/ac	
<i>glyphosate*</i>	2.52–4.32 kg/ha		
VANQUISH (480 g/L)	1.7 L/ha	0.68 L/ac	• Apply in at least 560 L/ha water (224 L/ac).
or ORACLE (480 g/L)			
plus 2,4-D (470 g/L)*	2.2 L/ha	0.88 L/ac	
<i>dicamba</i>	0.82 kg/ha		
plus 2,4-D*	1.1 kg/ha		

REDUCTION OF HERBICIDAL DRIFT

In the application of herbicides, especially of the hormone type (2,4-D, mecoprop, dichlorprop, dicamba, etc.) sensitive crops (grapes, tomatoes, turnips, tobacco, beans, carrots, beets, fruit trees, ornamental plants and many others) beyond the area being sprayed can be damaged by vapor or spray drift.

To reduce the danger of herbicidal drift:

- Use only amine formulations when it is necessary to apply phenoxy herbicides (2,4-D, mecoprop, dichlorprop, etc.) near sensitive, non-target plants.
- Very slight spray drift with herbicides containing dicamba can be more damaging to soybeans and other crops than equivalent amounts of 2,4-D spray drift. There is also a possibility of dicamba vapor drift from treated plant foliage during high temperatures (in excess of 25°C); thus, use of dicamba containing herbicides should be avoided near sensitive, desirable plants.

- Use the lowest pressure possible to apply the herbicide. This may mean the use of a dribble bar, Radiarc boom, vibrajel nozzle, Directa-spra nozzle, flood jet or more conventional nozzle tips.
- Manufacturer's recommendations regarding nozzle spacing and height should be carefully followed. It may be necessary to mount nozzles on skids to keep them at a constant distance from the surface to be sprayed.
- For roadside spraying various spray additives are available which may reduce spray drift by increasing the viscosity or density of the spray. These materials should be used following manufacturer's directions and observing normal precautions (vehicle speed, wind velocity, proximity to sensitive crops, etc.)

WARNING: These methods and materials can reduce but not eliminate herbicidal drift. In areas near sensitive crops, all normal precautions must be taken. It should be emphasized that extremely low, even invisible, amounts of spray drift can be very damaging to sensitive crops. In some cases, do not spray during the growing season.

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Concentration)
Active Ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

ROADSIDE WEED CONTROL

The main objectives of a weed control program for roadsides are: (1) to control tall growing weeds so that mowing costs can be minimized; (2) to control weeds that may infest adjacent land by wind dispersal of seed; (3) to maintain an attractive grass cover that will minimize erosion problems; (4) to prevent buildup of excessive vegetation that can become a fire hazard in the late summer or complicate snow removal in winter; and most importantly, (5) to ensure highway safety.

Most broadleaf weeds are susceptible to early summer applications of 2,4-D and related herbicides (See Table 18-2, *Classification of Weeds According to Response to Various Foliar Sprays*, page 335). However, many weeds are not effectively controlled by 2,4-D mixtures and these resistant weeds can become an increasing problem unless other herbicides are used. It may be justified using spot treatments with non selective chemicals that may temporarily injure the grass to control isolated, but dense, patches of difficult weeds before they spread and become a problem over a large area.

Postemergence Broadleaf Herbicides

2,4-D (470 g/L)* or 2,4-D (564 g/L)* or 2,4-D (660 g/L)*	2.2 L/ha 1.95 L/ha 1.67 L/ha	0.9 L/ac 0.78 L/ac 0.67 L/ac	• Apply as amine or low-volatile ester in 200–300 L/ha water (80–120 L/ac) in early summer. See Table 18-2, <i>Classification of Weeds According to Response to Various Foliar Sprays</i> , page 335 for weed susceptibilities for 2,4-D mixtures.
2,4-D*	1.1 kg/ha		
DIPHENOPROP BK 700 (679 g/L) or DESORMONE (680 g/L) or ESTAPROP (582 g/L) or DICHLORPROP D (582 g/L) or TURBOPROP 600 (582 g/L)	3.5 L/ha 3.5 L/ha 4 L/ha 4 L/ha 4 L/ha	1.4 L/ac 1.4 L/ac 1.6 L/ac 1.6 L/ac 1.6 L/ac	• Apply as the low-volatile ester in 200–500 L/ha water (80–200 L/ac) during early summer for most species.
dichlorprop/ 2,4-D	2.375 kg/ha		
GARLON 4 (480 g/L)	1–4 L/ha	0.4–1.6 L/ac	• Apply in 200–300 L/ha water (80–120 L/ac) when weeds are actively growing.
triclopyr	0.48–1.92 kg/ha		
MILESTONE (240 g/L)	0.25–0.5 L/ha	0.10–0.20 L/ac	• Apply Postemergence. • Will control: absinth (biennial) wormwood, goldenrod, knapweed, scentless chamomile, Canada thistle, yellow star thistle, musk (nodding) thistle, sulphur cinquefoil and tropical soda apple. • Will suppress: common tansy and dandelion.
aminopyralid	60–120 g/ha		
MILESTONE (240 g/L) + 2,4-D Amine (564 g/L)*	0.25–0.5 L/ha 1.49–2.55 L/ha	0.10–0.20 L/ac 0.596–1.02 L/ac	• Apply Postemergence. • For wider spectrum of weed control, 2,4-D amine may be added at a ratio of 1 part MILESTONE ai/ha to 12 parts 2,4-D amine ai/ha
aminopyralid plus 2,4-D Amine*	60–120 g/ha 840–1440 g/ha		
TELAR (75 DF)	75 g/ha	30 g/ac	• Add a surfactant to improve control.
chlorsulfuron	53 g/ha		

* See Table 4-1, *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4, <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5, <i>Notes on Adjuvants</i> , page 69).
TORDON 101 ((1:3.7)305 g/L) <i>picloram/2,4-D</i>	7 L/ha 2.14 kg/ha	2.8 L/ac	• Apply in 200 L/ha water (80 L/ac) during the spring or early summer after growth appears. Use an approved drift control additive or system. • A permit for purchase and use is required.
TRANSLINE (360 g/L) <i>clopyralid</i>	0.42–0.83 L/ha 0.15–0.3 kg/ha	0.17–0.33 L/ac	• For Canada thistle, perennial sow thistle, spotted knapweed and coltsfoot. • Treat when weeds are young and actively growing. • For coltsfoot, treatments should be performed prior to August. • Apply as a broadcast foliar in 200 L/ha water (80 L/ac) or in sufficient water to ensure thorough coverage of target vegetation. • For spot treatment apply in 800 L and spray weeds to the point of run-off.
VANQUISH (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	1.25 L/ha 0.6 kg/ha	0.5 L/ac	• For leafy and cypress spurge. Apply when weed is actively growing in 100–200 L/ha water (40–80 L/ac).
VANQUISH (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	2.3 L/ha 1.1 kg/ha	0.9 L/ac	• For goldenrod, apply when weed is actively growing in 100–200 L/ha water (40–80 L/ac). • For field bindweed, apply in mid June or when flowering.
VANQUISH (480 g/L) or ORACLE (480 g/L) <i>dicamba</i>	2.83 L/ha 1.36 kg/ha	1.13 L/ac	• For Canada thistle and perennial sow-thistle. • Apply sprays in late spring just prior to flowering or apply to regrowth escaping other treatments in summer or fall.
Postemergence Grass and Broadleaf Herbicides			
AMITROL 240 (231 g/L) <i>amitrole</i>	12.5–16.5 L/ha 3–4 kg/ha	5–6.6 L/ac	• For Canada thistle, perennial sow-thistle. • Apply to the point of runoff when the thistles are in the head stage of growth. • Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to 1 season.
AMITROL 240 (231 g/L) <i>amitrole</i>	18.75–28 L/ha 4.5–6.75 kg/ha	7.5–11.2 L/ac	• For milkweed, spray to wet in early summer before flowering. • For horsetail, toadflax, and quackgrass. • Spray when horsetail is growing vigorously. • Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to 1 season.
glyphosate (360 g/L)* or glyphosate (450 g/L)* or glyphosate (480 g/L)* or glyphosate (500 g/L)* or glyphosate (540 g/L)* <i>glyphosate*</i>	7–12 L/ha 5.6–9.6 L/ha 5.25–9 L/ha 5–8.64 L/ha 4.67–8 L/ha 2.52–4.32 kg/ha	2.8–4.8 L/ac 2.24–3.84 L/ac 2.1–3.6 L/ac 2–3.46 L/ac 1.87–3.2 L/ac	• For milkweed, field bindweed, Canada thistle, perennial sow-thistle. • Apply in 200–300 L/ha water (80–120 L/ac) when the weeds are in the bud to full flower stage. • Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to 1 season. • Also see, <i>Wiper Applicators for Selective Weed Control</i>, page 9.

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME
(Concentration)
Active Ingredient

PRODUCT RATE
PER HECTARE
active rate per ha

PRODUCT RATE
PER ACRE

PRECAUTIONS

(For more information, see Chapter 4, *Herbicides Used in Ontario*, page 23 and Chapter 5, *Notes on Adjuvants*, page 69).

VEGETATION CONTROL – LONG TERM NON-SELECTIVE

CAUTION: These chemicals should not be used to treat areas that are close to gardens, desirable trees, etc. Since these chemicals are non-selective (will kill any plant that they contact), special care must be used in their application. If the area (for example, a driveway) is higher than a nearby lawn, the chemical may wash onto the lawn with the first rain. If trees or shrubs are feeding under the treated areas, the chemical may leach to their roots and cause injury.

It may be desirable to maintain certain areas completely free of vegetation. Usually two problems are involved. First, the existing vegetation must be destroyed, including the destruction of underground stems and roots of perennials. Second, the bare area thus produced must be maintained either by persistent soil active chemicals or by foliage treatment of weed seedlings.

Some chemicals will kill existing vegetation. Others, while excellent for maintaining the bare area, may be used more economically if combined with another chemical to kill existing growth. If a mixed population of weeds is present, combinations of chemicals that will kill the different weed types may be used advantageously.

Uniform coverage with all chemicals is essential. Touch up operations should be expected, as a single treatment will seldom give complete eradication. Usually two applications of the lower recommended rate (i.e. 5.5–11 kg/ha), depending on the chemical used, spaced 6–12 months apart, give better results than a single application of the higher recommended rate. This approach also reduces the risk of off-site movement.

Bare Areas – Non selective control of all vegetation

ARSENAL (240 g/L)	3 L/ha	1.2 L/ac	• Apply in sufficient water (100–550 L/ha (40–220 L/ac)) to wet all foliage during periods of active growth.
<i>imazapyr</i>	0.72 kg/ha		
DIUREX 80WDG	11–27.5 kg/ha	4.4–11 kg/ac	• Apply this rate on sands and sandy loam soils.
<i>diuron</i>	8.8–22 kg/ha		
DIUREX 80WDG	40–55 kg/ha	16–22 kg/ac	• Apply this rate on clays or high organic soils.
<i>diuron</i>	32–44 kg/ha		
HYVAR X-L (240 g/L)	25.7–45 L/ha	10.3–18 L/ac	• Mullein is not adequately controlled by HYVAR X-L.
<i>bromacil</i>	6.16–10.8 kg/ha		
KARMEX (80 DF)	14–55 kg/ha	5.6–22 kg/ac	• Plantain is not adequately controlled by KARMEX.
<i>diuron</i>	11.2–44 kg/ha		
KROVAR ((1:1):80 DF)	13.5–18 kg/ha	5.4–7.2 kg/ac	
<i>bromacil/diuron</i>	10.8–14.4 kg/ha		

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
PAYLOAD WDG (51.1%) plus glyphosate (360 g/L)*	280–420 g/ha 3.3 L/ha	112–168 g/ac 1.3 L/ac	• Do NOT apply on soils with greater than 5% organic matter, or fine textured soils. • Do NOT apply to farm alleys or roads where traffic may result in treated dust settling onto crops or other desirable vegetation. • Do NOT apply with 100 metres of non-dormant pears. • Do NOT make more than two applications per growing season. • Apply high rate to medium textured soils. • Apply low rate to coarse textured soils. • This tank-mix provides residual control only for pigweed spp. common ragweed, lamb's-quarters, green foxtail, hairy nightshade, dandelion and Eastern black nightshade.
flumioxazin plus glyphosate	0.143–0.286 kg/ha plus 1.2 kg/ha		
VELPAR (90 SP)	4.5–9 kg/ha	1.8–3.6 kg/ac	
hexazinone	4.05–8.1 kg/ha		

VEGETATION CONTROL – LONG TERM SELECTIVE

Bare Areas – Prememergence Grass and Broadleaf Herbicides

PAYLOAD WDG (51.1%)	280–420 g/ha	112–168 g/ac	• Do NOT apply on soils with greater than 5% organic matter, or fine textured soils. • Do NOT apply to farm alleys or roads where traffic may result in treated dust settling onto crops or other desirable vegetation. • Do NOT apply with 100 metres of non-dormant pears. • Do NOT make more than two applications per growing season. • Apply high rate to medium textured soils. • Apply low rate to coarse textured soils. • Provides residual control of pigweed spp. common ragweed, lamb's-quarters, green fox-tail, hairy nightshade, dandelion and Eastern black nightshade.
flumioxazin	143–286 g/ha		

VEGETATION CONTROL – SHORT TERM NON-SELECTIVE

Foliage Treatment Chemical Mowing

Chemicals offer an alternative to mowing in areas where top kill of low growing vegetation is desired. The chemicals listed below are first applied when the growth is about 15 cm high. Spray to runoff. Tall vegetation is more difficult to kill and can become an unsightly fire hazard when it dies.

AMITROL 240 (231 g/L)	16.5 L/ha	6.6 L/ac	• Apply to actively growing foliage to be effective.
or glyphosate (360 g/L)*	5–7 L/ha	2–2.8 L/ac	• Apply in sufficient water (200–400 L/ha (80–160 L/ac)) to thoroughly wet all foliage.
or glyphosate (480 g/L)*	3.75–5.25 L/ha	1.5–2.1 L/ac	• With AMITROL 240, newly formed leaves turn white before the plants die. The appearance of foliage injury may be delayed during cool conditions.
or glyphosate (500 g/L)*	3.6–5 L/ha	1.44–2 L/ac	• Regrowth may occur from freshly germinating plants or from underground portions of perennial weeds. Also see <i>Wiper Applicators for Selective Weed Control</i>, page 9.
or glyphosate (540 g/L)*	3.3–4.67 L/ha	1.32–1.87 L/ac	
amitrole	4 kg/ha		
or glyphosate*	1.8–2.52 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TRADE NAME (Concentration) Active Ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
REGLONE 240 (240 g/L)	2.3–4.6 L/ha	0.92–1.84 L/ac	• Apply at the higher rates and in a high spray volume (1,000 L/ha (400 L/ac)) for dense weed growth.
diquat	0.55–1.1 kg/ha		• Use 1 L/1,000 L of AGRAL 90 as a wetting agent for best results.

WEED CONTROL IN DITCHES

When ditches on roadsides, or in other locations, contain standing or moving water, do not apply herbicides to emergent weeds without consulting the Ontario Ministry of the Environment regarding the need for a permit (see *Water Weeds*, page 339). However, such permits are not normally necessary to apply herbicides to control weeds adjacent to ditches or weeds in ditches when no water is present.

Take the following precautions:

- Spray when ditch or stream contains no flowing water.
- Avoid spraying directly onto water surface (violates *Pesticides Act*, *Water Resources Act*).
- Schedule spray programs so that extensive sections of stream bank or ditch bank are not sprayed at one time.
- Work upstream rather than downstream along the stream bank or ditch bank.
- Ascertain downstream water uses to avoid possible conflict with the rights of other landowners.

Emergents			
2,4-D (470 g/L)*	4.5 L/ac	1.8 L/ac	• For bulrushes.
or 2,4-D (564 g/L)*	4 L/ac	1.6 L/ac	• Apply as the low-volatile ester in 750–1,000 L/ha (300–400 L/ac) water.
or 2,4-D (660 g/L)*	3.4 L/ac	1.36 L/ac	
2,4-D*	2.25 kg/ha		
AMITROL 240 (231 g/L)	37.5–45.75 L/ha	15–18.3 L/ac	• For cattails.
amitrole	9–11 kg/ha		• Apply in a minimum of 1,000 L/ha (400 L/ac) water from the time cattails are formed until frost.
glyphosate (360 g/L)*	7–12 L/ha	2.8–4.8 L/ac	• For cattails.
or glyphosate (450 g/L)*	5.6–9.6 L/ha	2.24–3.84 L/ac	• Apply during mid to late flowering stage (mid July to late August) when cattails are actively growing.
or glyphosate (480 g/L)*	5.25–9 L/ha	2.1–3.6 L/ac	• For isolated spots use a 1% solution (1 L product in 100 L water) and spray to wet all foliage but not to the point of runoff.
or glyphosate (500 g/L)*	5–8.64 L/ha	2–3.46 L/ac	
or glyphosate (540 g/L)*	4.67–8 L/ha	1.87–3.2 L/ac	
glyphosate*	2.52–4.32 kg/ha		

* See Table 4-1. *Herbicides Used in Ontario*, page 23, for formulations available. See label for specific uses and rates.

TABLE 18-1. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays

Common Name	2,4-D	2,4-D Dichlorprop (1:1)	2,4-D Dicamba (2:1)	Fosamine Ammonium	2,4-D Picloram (3.7:1)	Triclopyr
alder	S-I	S	S	S	S	S
arborvitae	R	R	S		S	
ash	R	S-I	I-R	S-I	I-R	S
barberry, common	I	S		S	S-I	
basswood	R	S	S	S	S	S
beech	R		I	S-I	S	S-I
birch	S	S	S		S	S
blackberry	R		I-R	S	S-I	S
blueberry	S	S	I-R	I	S	S-I
buckthorn	I-R		I-R		S	S
cedar	R	I-R	S		S	
cherry, black, red	S-I	S	S	S-I	S	S-I
cherry, choke	S-I	S	S	S	S	S
cranberry	S					
creeper, virginia	S	S-I	S	S-I	S	
currants, wild	R		S			
dogwood	S-I	S		S	S	S
elderberry	S		S-I		S	S
elm	I	S-I	S	S-I	S	S-I
fir, balsam	R	S-I	S		S	I-R
grape, wild	S	S	S		S	S
hardhack, spirea	I				S	
hawthorn	I-R	S	S-I	S	S	S
hemlock	R				S	
hickory, black, shagbark	R	S-I	S	I		S
honeysuckle	S-I	S	S		S	
ironwood	R	S-I	S		S	S
juniper	R	I-R	S		S-I	
lilac	I-R				S	
locust, black	I				S	S

S - Susceptible. Adequate control obtained with one application.

I - Intermediate. Retreatment is usually needed for adequate control.

R - Resistant. Two or more applications may not be adequate.

TABLE 18-1. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays (cont'd)

Common Name	2,4-D	2,4-D Dichlorprop (1:1)	2,4-D Dicamba (2:1)	Fosamine Ammonium	2,4-D Picloram (3.7:1)	Triclopyr
locust, honey	S-I				S	S-I
maple, Manitoba	S-I	S	S	S-I	S	S
maple, red	R	I-R	I-R	S-I	S	S-I
maple, silver	S-I				S	S
maple, sugar	R	S-I	I-R		S	S
oak, red	I	I-R	S	I-R	S-I	S
oak, white	I	S-I	S-I		S-I	I
oak, bur	R-I		S	I-R	S	
pine	R	S-I	S	I-R	S	I
plum, wild	I	S		S		
poison-ivy	I	S-I	S	I	S	S
poplar, aspen	S	S	S		S	S
prickly-ash	R		S	S		S
raspberry, wild	R	S	I	S		S
redbud rhododendron	R				R	S
rose, wild	R	I	S	S	S	S
sassafras	S-I					S
sheep-laurel	I		S		S-I	S
spruce	R	I-R	S		S-I	R
sumac, poison	S					S
sweet-fern	I		S	S-I	S	
viburnum	R					S
walnut	S-I				S	
willow	S	S	S	S	S	S

S - Susceptible. Adequate control obtained with one application.

I - Intermediate. Retreatment is usually needed for adequate control.

R - Resistant. Two or more applications may not be adequate.

TABLE 18-2. Classification of Weeds According to Response to Various Foliage Sprays

Common Name	2,4-D	MCPA	2,4-DB or MCPB	Mecoprop	Dicamba
aster (perennial)	I				
bedstraw (perennial)	R	I-R	R	I	R
bellflower (perennial)	R				
bindweed, field (perennial)	I	I	I	I	S-I
bluweed (biennial)	S-I	I		I	I
bracken fern (perennial)	R	R	R	R	I
buckwheat, wild (annual)	I-R	I	I-R	I-R	S
burdock (biennial)	S	S	I		S
buttercup (perennial)	I-R	S-I	I**(I-R)	I	I
campion, bladder (perennial)	R	R	R	R	
carrot, wild (biennial)	S-R	S-R	R	I-R	S
catchfly, night-flowering (annual)	R	R	R	R	
catnip (perennial)	S-I				
chickweed, common (annual)	I-R	I	R	S	S
chickweed, mouse-eared (perennial)	I-R	I-R	R	S	S
chicory (perennial)	S	S-I	S-I*(R)	I-R	S
cinquefoil, rough (winter annual)	I				
cinquefoil, sulphur (upright c.), (perennial)	I				
cocklebur (annual)	S	S	S	S	S
cockle, purple (annual)	I-R	R	R		I
cockle, white (perennial)	R		I-R		I
daisy, ox-eye (perennial)	I	I	R	I	I
dandelion (perennial)	S	S	I*(R)	I	S
dock (perennial)	I	I	I	I	
evening-primrose (biennial)	S				
false flax (winter annual)	S	S	S	S	S
fleabane, annual (daisy f.) (winter annual)	I	I	S-I		
fleabane, Canada (annual)	S-I				
goat's-beard (biennial)	I				
golden rod (perennial)	I	R	I	I	

* 2,4-DB more effective (susceptibility to MCPB in brackets).

** MCPB more effective (susceptibility to 2,4-DB in brackets).

S - Susceptible. Killed by 1 application of 2,4-D, MCPA or Mecoprop (1.2 kg or less per ha); or by 1 application of dicamba (425 g or less per ha).

I - Intermediate. Killed less rapidly but controlled by higher rates or by repeated applications.

R - Resistant. Not affected or only slightly damaged by chemical treatment. Control of this weed is not practical with herbicide(s) listed at the top of this column.

TABLE 18-2. Classification of Weeds According to Response to Various Foliage Sprays (cont'd)

Common Name	2,4-D	MCPA	2,4-DB or MCPB	Mecoprop	Dicamba
goosefoot (annual)	S	S	S	S	
goutweed (perennial)	R	R	R	R	
grasses (annual and perennial)	R	R	R	R	
ground-ivy (creeping charlie) (perennial)	I-R	I-R		I	S
groundsel (annual)	I	I			
hawkweed (perennial)	I-R	I-R			S-I
heal-all (perennial)	I-R	I-R	I-R	S	S
hemp-nettle (annual)	R	S-I	I-R**(R)	R	
horse-nettle (perennial)	R				I
horse-tail (perennial)	I-R	S-I	I-R	I-R	I
knapweeds (perennial)	R		I*(I-R)		I
knotweed (annual)	I-R		I-R*(R)	S-I	S
lady's thumb (annual)	S-I	I-R	S	I-R	S
lamb's-quarters (annual)	S	S	S	S	S
lettuce, prickly (annual)	S-I	S	I-R	S	
mallow, round-leaved (perennial)	I-R	I-R	R	I-R	
mayweed (annual)	I-R		I		S
medick, black (winter annual)	I	I		S	I
milkweed (perennial)	R	R	R	I-R	I-R
motherwort (perennial)	S-I				
mullein (biennial)	I-R				
mustards (annual)	S	S	I	S	
nightshade (perennial)	I-R			R	
parsnip, wild (biennial)	S				
pepper-grass, common (winter annual)	S	S-I	I		
pepper-grass, field (winter annual)	S	S	I		
pigweeds (annual)	S	I	S-I	S	S
pineappleweed (annual)	S		R	R	
plantains (perennial)	S	S	S-I	S-I	I
purslane (annual)	I	I	S-I	S-I	

* 2,4-DB more effective (susceptibility to MCPB in brackets).

** MCPB more effective (susceptibility to 2,4-DB in brackets).

S - Susceptible. Killed by 1 application of 2,4-D, MCPA or Mecoprop (1.2 kg or less per ha); or by 1 application of dicamba (425 g or less per ha).

I - Intermediate. Killed less rapidly but controlled by higher rates or by repeated applications.

R - Resistant. Not affected or only slightly damaged by chemical treatment. Control of this weed is not practical with herbicide(s) listed at the top of this column.

TABLE 18-2. Classification of Weeds According to Response to Various Foliage Sprays (cont'd)

Common Name	2,4-D	MCPA	2,4-DB or MCPB	Mecoprop	Dicamba
ragweed (annual)	S	S	S	S	S
ragwort (biennial and perennial)	I-R	R	R	I	S-I
ribgrass (see plantains) (perennial)					
rocket, yellow (biennial)	S	I	I*(R)		
shepherd's purse (winter annual)	S-I	S	S-I	S-I	
smartweed, green (annual)	S-I	I-R	I-R	I-R	S
sorel, sheep (perennial)	I	R			
sow-thistle, annual (annual)	S	I	S-I	I	S-I
sow-thistle, perennial (perennial)	I	R	S-I*(I-R)		S-I
speedwells (annual and perennial)	I-R	I-R		S-I	I
spurge, cypress (perennial)	I-R	I-R	I-R		I
spurge, leafy (perennial)	I-R	I-R	I-R	R	S
spurry, corn (annual)	R	I	R	I	R
St. John's wort (perennial)	R	R	R	R	S
stinkweed (pennycress) (winter annual)	S	S	S-I	S-I	
stonecrop, mossy (perennial)	I	I		S-I	
teasel (biennial)	S				
thistle, bull (biennial)	S	S	S	S	S-I
thistle, Canada (perennial)	I	I	I	I	
thistle, nodding (biennial)	I		I		S-I
thistle, Russian (annual)	S-I		I-R	R	
toadflax (perennial)	R	R	R	R	S-I
velvetleaf (annual)	S-I	I	S-I*(I-R)		I
vetch (perennial)	I-R	I-R	R	I-R	I
vetches, wild (annual)	S	S			
violet, field (field pansy) (annual)	R			R	
water-hemlock (perennial)	S-I				
wood-sorrel (perennial)	I-R				
yarrow (perennial)	R	I-R		I-R	I-R

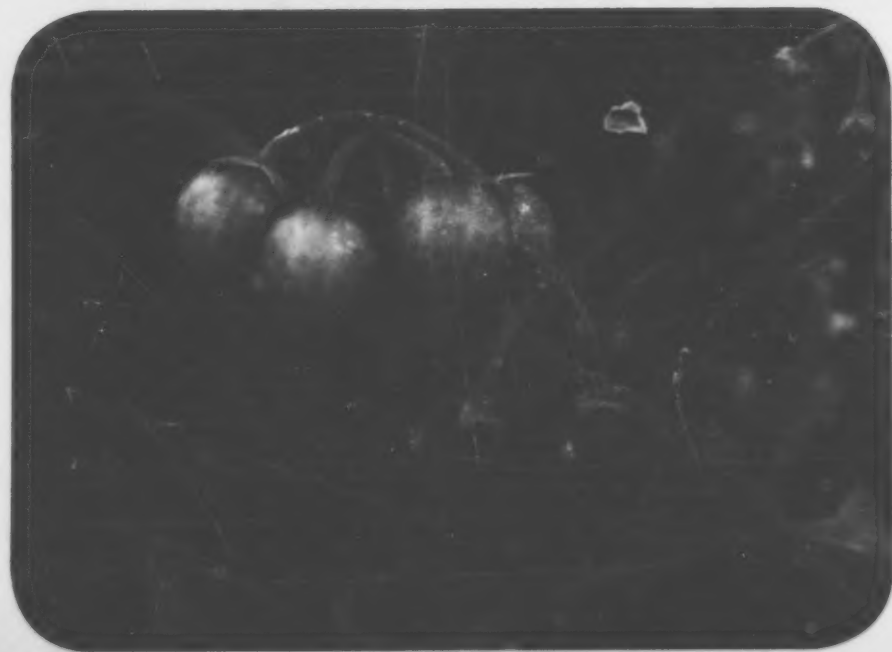
* 2,4-DB more effective (susceptibility to MCPB in brackets).

** MCPB more effective (susceptibility to 2,4-DB in brackets).

S - Susceptible. Killed by 1 application of 2,4-D, MCPA or Mecoprop (1.2 kg or less per ha); or by 1 application of dicamba (425 g or less per ha).

I - Intermediate. Killed less rapidly but controlled by higher rates or by repeated applications.

R - Resistant. Not affected or only slightly damaged by chemical treatment. Control of this weed is not practical with herbicide(s) listed at the top of this column.



19. WATER WEEDS (AQUATIC PLANTS)

Water Weeds

Under the *Pesticides Act* and Ontario Regulation 63/09 a person requires an Aquatic Vegetation exterminator licence to use a herbicide to control aquatic plants and a permit issued by the Ministry of the Environment (MOE) to perform a water extermination. However, there are exemptions under Regulation 63/09 from the licence and permit requirements for certain premises.

Section 83 identifies exemptions from the requirements for an aquatic exterminator licence and permit for water exterminations.

Specified premises

83. (1) This section applies to a water extermination performed on,
- (a) premises that are owned or occupied by the person who performs the extermination; or
 - (b) premises that are owned or occupied by the full-time employer of the person who performs the extermination. O. Reg. 63/09, s. 83 (1).
- (2) A person who performs a water extermination mentioned in subsection (1) is exempt from subsection 5 (1) of the Act with respect to the performance of an extermination in, on or over a portion of surface water that is located within the boundaries of premises mentioned in subsection (1). O. Reg. 63/09, s. 83 (2).
- (3) A person who performs a water extermination mentioned in subsection (1) is exempt from subsection 7 (2) of the Act with respect to the extermination if,

- (a) the person performs the extermination in, on or over surface water that is located wholly within the boundaries of the premises mentioned in subsection (1); and,
- (b) no discharge of the water occurs by any means directly or indirectly, other than by percolation, into a well, lake, river, pond, spring, stream, reservoir or other water or watercourse that is located wholly or partly outside the boundaries of the premises. O. Reg. 63/09, s. 83 (3).

To summarize:

- A person is exempt from the requirement for an aquatic vegetation exterminator licence if they are performing a water extermination on premises they own or occupy or on premises that are owned or occupied by their full-time employer and the extermination is being done in, on or over a portion of surface water that is located within the boundaries of those premises; and,
- a person is exempt from the requirement for a permit if they are performing a water extermination on premises they own or occupy or on premises that are owned or occupied by their full-time employer and the extermination is being done on a water body that is wholly contained on those premises and the water body does not discharge, directly or indirectly (other than by percolation) into any water or watercourse. Consequently, a person may apply herbicides in a wholly contained pond that has no outflow if that pond is located on the property of the person who is either doing the extermination themselves or whose full-time employee is doing the extermination.

Sale of Aquatic Herbicides

In Ontario, aquatic herbicides are classified as non-domestic pesticide products (Class 3 or 4). Pesticide vendors may sell an aquatic herbicide to only those persons that possess the appropriate licence and/or permit.

A person who holds an Aquatic Vegetation exterminator licence may purchase a Class 3 or 4 herbicide for aquatic plant control. However, as described above, a permit is required unless the exterminator is performing a water extermination on premises they own or occupy or on premises that are owned or occupied by their full-time employer and the extermination is being done in, on, or over surface water that is wholly contained on those premises and the water body does not discharge, directly or indirectly (other than by percolation) into any water or watercourse.

Also, as described in the summary section above, there are situations where a person may be exempt from both the requirement for an Aquatic Vegetation exterminator licence and a permit (e.g. a person owns or occupies the property, or is a full time employee of the person that owns or occupies the property, upon which a water extermination is to occur, and the water body is wholly contained within the boundaries of that property and has no direct or indirect outflow). However, in order for a vendor to sell a non-domestic product (Class 3 or 4) to the person that person will require a letter signed by an MOE Director confirming that the person is exempt from requiring a exterminator licence and permit to purchase a Class 3 or 4 product for aquatic plant control.

Notes:

- Qualified farmers are permitted to purchase and use Class 3 and 4 pesticides for a land extermination only on their own farmland. The use of an aquatic herbicide is a water extermination, not a land extermination. Therefore, unless the above noted licence and/or permit exemptions apply, a farmer must obtain the appropriate water exterminator licence and/or permit to use a Class 3 or 4 aquatic herbicide.
- A person does not require an MOE permit to apply appropriately labelled Class 3, 4, 5, 6 or 7 pesticides in a drainage ditch to control plants that emerge from or float on the surface of the water if the drainage ditch does not contain moving water at the time of the extermination. A "drainage ditch" is defined in Regulation 63/09 as an artificial watercourse, added to the natural land drainage system, primarily to collect and convey water and that, for some period each year, does not contain moving water.

Non-chemical Control Methods

Reducing or eliminating the flow of nutrients into water bodies is an effective preventative measure to control excessive aquatic weeds. Herbicides only provide temporary control of nuisance aquatic vegetation. Alternate methods such as mechanical removal of submergent plants, dredging or substrate alteration of drainage ditches can provide longer-term control. Mechanical control measures may have an impact on fish habitat and therefore would require approval from the Ministry of Natural Resources. Management techniques for vegetation control in ponds include minimizing nutrient input, dredging excess sediment, logs and other organic debris, decreasing the surface to depth ratio and increasing the rate of pond turnover (flushing). Some aquatic plant and algae life should be accepted and tolerated as a vital component of a healthy ecosystem.

Aquatic vegetation can vary widely; species include completely submerged plants such as Canada Waterweed

and algae; free floating plants such as water lilies; and emergent plants such as cattails and bulrushes. Many emergent plants will grow equally as well on the moist shoreline as when their lower stems and roots are in water. Where these emergent species have taken possession of the shoreline, control measures must embrace that area as well as the water.

Stonewort and muskgrass are a gray green to green plant-like algae, attached to the sediment, or free floating. In dense communities this plant-like algae has a very strong musk odour. It is brittle to the touch and will dry to a white powder upon removal from the water.

Tapegrass (wild celery) is found in many recreational lakes, is resistant to all the currently recommended herbicides. It has long rubbery leaves and numerous short roots. Control is possible only by mechanical methods. Applications of herbicides over several years may be necessary for effective control of cattails and bulrushes.

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
Algae and Vascular Submergents			
(e.g. Chara, Canada Waterweed, Coontail, Water Milfoil, Bladderwort, Pondweed)			
POLYDEX (5%) or POLYPRO (5%)	1 L/60,000 L		• To control algae in ponds, lagoons, dugouts and potable water tanks. • Do NOT apply or allow discharge to lakes, flowing water or ponds with outflow. • This product is toxic to fish, aquatic invertebrates and plants. • Effective application rate depends on water condition and the extent of micro-organisms present.
Copper sulphate	16 mL/1,000 L		
THINK PURITY ALGAECIDE SOLUTION (5%)	1 L/60,000–600,000 L		• To control algae in ponds, lagoons and dugouts • Do NOT apply or allow discharge to lakes, flowing water or ponds with outflow. • This product is toxic to fish, aquatic invertebrates and plants. • To avoid oxygen depletion do NOT treat more than half of a pond or dugout at one time.
Copper sulphate pentahydrate	16 mL/1,000 L		
CUPROSE (18.9%)	6.5–9.0 kg/ha in water bodies with a depth of		• To control algae in farm ponds. • Do NOT apply or allow discharge to lakes, flowing water or ponds with outflow. • Do NOT apply to areas frequented by wildlife. • This product is toxic to fish and other aquatic animals.
Copper	1 M		

TRADE NAME (Concentration) active ingredient	PRODUCT RATE PER HECTARE active rate per ha	PRODUCT RATE PER ACRE	PRECAUTIONS (For more information, see Chapter 4. <i>Herbicides Used in Ontario</i> , page 23 and Chapter 5. <i>Notes on Adjuvants</i> , page 69).
REWARD (240 g/L)	18.3–29.2 L/ha	7.4–11.8 L/ac	• For control of coontail, Canada waterweed and pondweed in still or slow-moving water of farm dugouts, farm ponds, farm ditches, lakes and canals. • Treat dense populations of duckweed as submergent and apply as surface spray on foliage. • <i>Chara</i> (stonewort, musk grass) are not controlled. • Do NOT use treated water for animal consumption or swimming for at least 24 hours. • Do NOT use for human consumption or irrigation for at least 5 days. • To avoid oxygen depletion, treat only 1/4 to 1/3 of the area at a time. • Rate depends on water depth: – less than 1.5 m – use 18.3 L/ha (7.4 L/ac) – more than 1.5 m – use 25 to 29.2 L/ha (10.1 to 11.8 L/ac) • Apply when plants are young and growing vigorously. • Application to dense growth of mature weeds will not give satisfactory control.
diquat (aquatic)	4.4–7 kg/ha		
REWARD (240 g/L)	9.2 L/ha	3.7 L/ac	• For control of water milfoil in lakes. • Treat when plants are in the very early stage of growth (June). • See REWARD note above.
diquat (aquatic)	2.2 kg/ha		
Emergents			
(e.g. Duckweed, Cattail)			
AMITROL 240 (231 g/L)	37.5–45.75 L/ha	15–18.3 L/ac	• Cattails in non-crop areas (roadsides, fencerows, ditch banks, drainage ditches). • After catkins are fully formed and up to frost. • Do NOT disturb sprayed plant. • Do NOT apply where water will be used for irrigation, drinking or other domestic uses. • Do NOT apply where water is not wholly confined to user's property. • Apply at a spray volume of 1,000 L/ha (400 L/ac) water.
amitrole	9–11 kg/ha		
REWARD (240 g/L)	18.3–29.2 L/ha	7.4–11.8 L/ac	• Duckweed. • Apply by directed surface spray on foliage. • Rate depends on water depth: – less than 1.5 m – use 18.3 L/ha (7.4 L/ac). – more than 1.5 m – use 25–29.2 L/ha (10.1–11.8 L/ac). • Use in 1700–2200 L/ha (680–880 L/ac) water. • See REWARD note in previous section.
diquat (aquatic)	4.4–7 kg/ha		

TABLE 19-1. Habitats and Herbicide Susceptibility of Common Aquatic Plants

	Spring-fed pond	Dugout	Soft water lake*	Hard water lake**	Wet ditch***	Dry ditch****	Mechanical control	Copper compound (1)	Diquat (2)	Amitrole (3)
Algae										
<i>Pithophora</i>									S-I	
<i>Spirogyra</i> spp.	VC	VC	C-I		VC	I		S	R	
<i>Ulothrix</i> spp.	C	VC			VC			S	R	
<i>Mougeotia</i> spp.	C	VC			VC			S	R	
<i>Cladophora</i> spp.	VC	VC	C	VC	VC	VC		S	R	
<i>Chara</i> spp. (Muskgrass)	VC	I	C-I	VC-I	VC	R		S	R	
<i>Nitella</i> spp. (Stonewort)	I	R	VC	R	R	R		S	R	
Submergent Macrophytes										
Sago pondweed (<i>P. pectinatus</i>)	I	C-I		VC				R	S	
Curly-leaf pondweed (<i>P. crispus</i>)	C	VC		VC				R	S	
Bassweed (<i>P. amplifolius</i>)	R	C		C				R	I	
Richardson pondweed (<i>P. richardsonii</i>)				VC-C				R	S-I	
Flat-stemmed pondweed (<i>P. zosteriformis</i>)				C				R	S	
Other narrow-leaf pondweed (<i>Potamogeton</i> spp.)	I	C	C	VC-C				R	S	
Eurasian water milfoil (<i>Myriophyllum spicatum</i>)			VC					R	VS	
Native milfoil (<i>M. exalbescens</i> and others)	C		C	VC				R	VS	
Bladderwort (<i>Utricularia vulgaris</i>)		C		C				R	S-I	
Coontail (<i>Ceratophyllum demersum</i>)		C		VC				R	I	
Water stargrass (<i>Heteranthera dubia</i>)				C				R	S-I	
Tape grass (<i>Vallisneria spiralis</i>)	R	I	C	VC	R	R	M**	R	R	R
Water naiad (<i>Najas flexilis</i>)		I		VC				R	S	
Canada waterweed (<i>Elodea canadensis</i>)		C		VC				R	I	

VC – very common; C – common; I – infrequent; R – rare

S – susceptible; I – intermediate; R – resistant

M – Manual or mechanical methods equally as effective as herbicides.

M* – Manual or mechanical methods are generally more effective than herbicides.

M** – Manual or mechanical methods are the only control measure currently available.

Bur reed is also very common as a submerged plant in ecotypes C and D.

^ Weeds denoted with an "R" may be damaged but will likely recover.

* – A typical Muskoka lake is an example of a soft water lake.

** – A typical Kawartha lake is an example of a hard water lake.

*** – A wet ditch contains water at time of treatment.

**** – A dry ditch contains no water at time of treatment.

(1) Copper compound (POLYDEX).

(2) Diquat (REGLONE A).

(3) Amitrole (AMITROLE 240).

TABLE 19-1. Habitats and Herbicide Susceptibility of Common Aquatic Plants (cont'd)

	Spring-fed pond	Dugout	Soft water lake*	Hard water lake**	Wet ditch***	Dry ditch****	Mechanical control	Copper compound (1)	Diquat (2)	Amitrole (3)
Emergents										
Cattails (<i>T. latifolia</i> , <i>T. angustifolia</i>)	VC	VC		VC	VC	I-C	M	R	R	S-I
Bulrush (<i>Scirpus</i> spp.)			C	VC	C	C	M	R		S-I
Sedge (<i>Carex</i> spp. + A42)			C	C	C	VC	M	R		S-I
Bur reed (<i>Sparganium</i> spp.)	C		C	C	C	VC	M	R		I
Water plantain (<i>Alisma</i> spp.)			I	C	C	VC		R		S
Pipewort (<i>Eriocaulon</i> spp.)	R	R	C	R	R	R	M*	R		
Arrowhead (<i>Sagittaria</i> spp.)		C		VC	I-C			R		
Pickerselweed (<i>Pontederia</i> spp.)			VC		I	R		R		
Water smartweed (<i>Polygonium amphibium</i>)	I	I						R		
Water shield (<i>Brasenia</i> spp.)			C					R		
White water lily (<i>Nymphaea</i> spp.)			C	C			M*	R		
Yellow water lily (<i>Nuphar</i> spp.)		C-I	C	C			M*	R		
Duckweed (<i>Lemna</i> spp.)	R	C	I-R	VC				R	S	
Duckmeal (<i>Wolffia</i> spp.)	R	C-I	I-R	VC				R	S	

VC – very common; C – common; I – infrequent; R – rare

S – susceptible; I – intermediate; R – resistant

M – Manual or mechanical methods equally as effective as herbicides.

M* – Manual or mechanical methods are generally more effective than herbicides.

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Bur reed is also very common as a submerged plant in ecotypes C and D.

^ Weeds denoted with an "R" may be damaged but will likely recover.

* – A typical Muskoka lake is an example of a soft water lake.

** – A typical Kawartha lake is an example of a hard water lake.

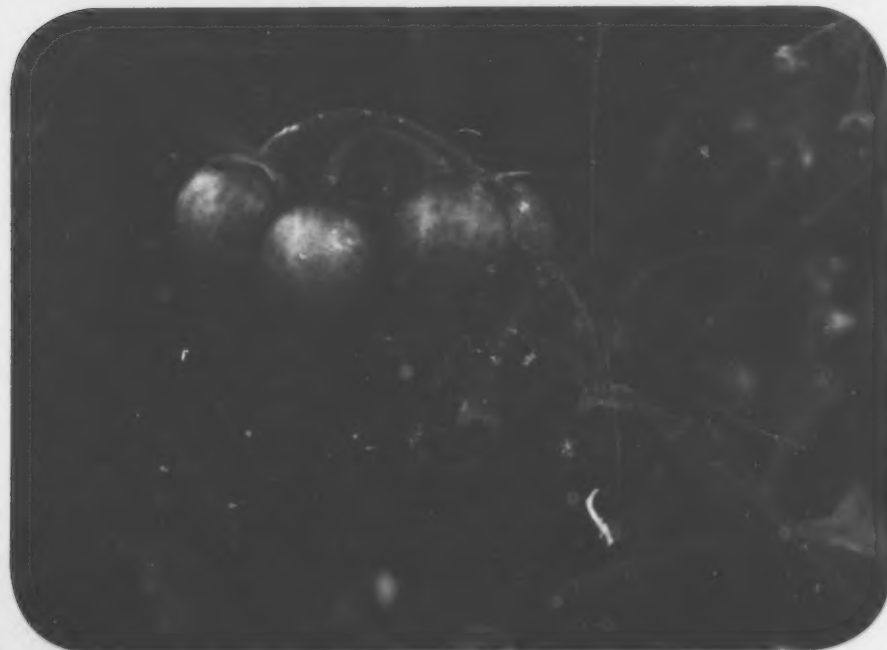
*** – A wet ditch contains water at time of treatment.

**** – A dry ditch contains no water at time of treatment.

(1) Copper compound (POLYDEX).

(2) Diquat (REGLONE A).

(3) Amitrole (AMITROLE 240).



APPENDIX A. Contributors to Guide to Weed Control, 2010–2011

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APPENDIX B. Weed Control Glossary

Acid Equivalent (abbreviation – a.e.) (2,4-D, glyphosate) – the active part of the acid herbicide being used – usually indicated in grams/L on the label.

Active Ingredient – the chemical in a formulated product that is responsible for the herbicide effects.

Adjuvant – an ingredient added to a herbicide formulation or spray mixture to aid or modify the action of the herbicide, or the physical characteristics of the mixture.

Amine – acid or anionic herbicides can be formulated as ammonium salts or amines. 2,4-D amines are relatively non-volatile under most climatic conditions.

Annual Plant – completes its life cycle within a one year period. Summer annuals complete their life cycle between spring and fall. Winter annuals germinate in fall, overwinter and then flower and complete their life cycle the following spring or summer.

Band Treatment – a herbicide applied as a narrow strip over the crop row, usually followed by inter-row cultivation.

Biennial Plant – completes its life cycle within a two-year period. Germinates in the spring, overwinters, flowers the following spring or summer and dies back the following fall.

Carrier – the diluent or material added to a herbicide product to facilitate its even distribution over the target area. The carrier is often water but it may also be granular products, oil or other solvents.

Compatible – compounds or formulations that can be mixed and applied together without undesirably altering their separate effects or the physical properties of the mixture.

Contact Chemicals – chemicals that kill only the parts of the plant on which they are sprayed. Movement within the plant is minimal.

Cotyledons – the seed leaves. Often visible when large seeds are opened. These are the first leaves visible in the germinated seedling. Broad-leaved crops or weeds have two cotyledons(dicots). Grasses (monocots) have one.

Directed Treatment – a treatment directed onto the weeds or soil in such a manner as to avoid contact with the crop.

Dormant – a resting stage similar to the condition of a plant during the winter.

Emergence – the time at which the seedling first appears above the ground.

Escape – a plant in a treated area that has been missed or survived the treatment.

Ester – some acid herbicides are reacted with alcohols to produce ester formulations. Ester formulations of 2,4-D and related herbicides can vaporize under hot conditions after treatment and cause unwanted damage by moving away from the treated area.

Formulation – means the same as Product – an active ingredient processed with other materials or formulants to make it easier to apply and/or more effective. Herbicides are rarely sold as pure active ingredients(2,4-D acid), they are sold as formulated mixtures(i.e. 2,4-D amine, sodium salt or ester with added emulsifiers, adjuvants, carriers, etc).

Half-Life – the time required for 50% of a herbicide to be degraded or inactivated in soil or water.

Herbicide – a chemical that is toxic to plants. Herbicide Tolerant Crops (abbreviation – HTC's) – New varieties of crops that have been developed by classical breeding or transgenic techniques to be tolerant to specific herbicides.

Hormone-Type Herbicide – includes 2,4-D, 2,4-DB, mecoprop MCPA, MCPB, dichlorprop, dicamba and triclopyr, picloram. At extremely low concentrations, these chemicals can stimulate and/or disrupt the growth of broadleaved plants.

Non-Selective Herbicide – a chemical used in such a manner that all exposed vegetation is damaged.

Perennial Plant – lives for more than 2 years.

Product – the contents of a herbicide container as marketed. In addition to the active ingredient, it may also contain other solvents, surfactants or carriers that are referred to as inert ingredients or formulants.

Program – application of one or more herbicides at two different stages of crop and/or weed growth. The second herbicide application is used to provide control of the weeds either escaping the original herbicide treatment or that are problems at different periods in the growth of the crop.

Resistant Weeds (Herbicide Resistant Weeds) – the inherited ability of some weeds in the population of a particular weed species to survive a herbicide application to which most of the original population was susceptible.

Selective Herbicide – a chemical used in such a manner that it will kill weeds on a growing crop without damaging the crop.

Sodium Salt – some acid or anionic herbicides can be formulated as sodium salts (e.g. 2,4,-D).

Soil Sterilant – a soil active herbicide that is applied at a sufficiently high rate to prevent all plant growth for at least one season.

Surfactant – a chemical added to the herbicide formulation or to the spray solution to improve the dispersing, spreading, sticking or wetting properties of the spray mixture.

Susceptible – a crop that may be damaged or a weed that may be readily controlled by a recommended rate of herbicide.

Tank-Mix – two chemicals that are packaged separately and mixed in the sprayer tank.

Translocated Herbicide – a chemical herbicide that moves within the plant.

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General Phone: 905-562-4141 Fax: 905-562-3413		Box 7000, 4890 Victoria Avenue North, Vineland Station, ON L0R 2E0	
Greenhouse Floriculture Specialist	Wayne Brown	905-562-4141 ext. 179	wayne.brown@ontario.ca
Greenhouse Floriculture IPM Specialist	Graeme Murphy	905-562-4141 ext. 106	graeme.murphy@ontario.ca

APPENDIX C. Ontario Ministry of Agriculture, Food and Rural Affairs Crop Advisory Staff List (cont'd)

Vineland Resource Centre			
General Phone: 905-562-4147 Fax: 905-562-5933		Adv. Serv. Building, Box 8000, 4890 Victoria Avenue North, Vineland Station, ON L0R 2E0	
Entomology, Horticulture Program Lead	Hannah Fraser	905-562-1674	hannah.fraser@ontario.ca
Nutrient Management Horticulture Crops Program Lead	Donna Speranzini	905-562-1170	donna.speranzini@ontario.ca
Tender Fruit and Grape IPM Specialist	Wendy McFadden-Smith	905-562-3833	wendy.mcfadden-smith@ontario.ca
Tender Fruit and Grape Specialist	Ken Slingerland	905-562-1639	ken.slingerland@ontario.ca
Woodstock Resource Centre			
General Phone: 519-537-6621 Fax: 519-539-5351		Box 666, Highway #59 North, Woodstock, ON N4S 7Z5	
Nutrient Management Field Crops Program Lead	Christine Brown	519-537-8305	christine.brown1@ontario.ca
University of Guelph			
General Phone: 519-824-4120		50 Stone Road East, Guelph, ON N1G 2W1	
Applied Research Coordinator – Field Crops, Crop Science Building	Ian McDonald	519-824-4120 ext. 56707 Fax: 519-763-8933	ian.mcdonald@ontario.ca
Corn Industry Program Lead Crop Science Building	Greg Stewart	519-824-4120 ext. 54865 Fax: 519-763-8933	greg.stewart1@ontario.ca
Nursery Crops Specialist Edmund Bovey Building	Jennifer Llewellyn	519-824-4120 ext. 52671 Fax: 519-767-0755	jennifer.llewellyn@ontario.ca
Nutrition – Horticulture Program Lead Land Resource Science, Richards Building	Christoph Kessel	519-824-4120 ext. 52480 Fax: 519-824-5730	christoph.kessel@ontario.ca
Pathologist – Horticulture Crops Program Lead, Edmund Bovey Building	Michael Celetti	519-824-4120 ext. 58910 Fax: 519-767-0755	michael.celetti@ontario.ca
Turfgrass Specialist, Guelph Turfgrass Institute 328 Victoria Road South, R.R. #2 Guelph, ON N1H 6H8	Pam Charbonneau	519-824-4120 ext. 52597 Fax: 519-766-1704	pamela.charbonneau@ontario.ca
Weed Management Field Crops Program Lead, Crop Science Building, Room 303	Mike Cowbrough	519-824-4120 ext. 52580 Fax: 519-763-8933	mike.cowbrough@ontario.ca

Agricultural Information Contact Centre

Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Road West

Guelph, ON N1G 4Y2

Tel: 519-826-4047

Toll-free: 1-877-424-1300

Fax: 519-826-7610

E-mail: ag.info.omafr@ontario.ca

APPENDIX D. Ontario Ministry of Environment – Regional Offices Contact Information

REGION County	Address	Telephone/Fax
Central Region Toronto, Halton, Peel, York, Durham, Muskoka, Simcoe	5775 Yonge Street, 8th Floor Toronto, ON M2M 4J1	Tel: 416-326-6700 Toll Free: 1-800-810-8048 Fax: 416-325-6345
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King Street West, 12th Floor Hamilton, ON L8P 4Y7	Tel: 905-521-7640 Toll Free: 1-800-668-4557 Fax: 905-521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Haliburton, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Twp of South Algonquin)	1259 Gardiners Road, Unit 3 PO Box 22032 Kingston, ON K7M 8S5	Tel: 613-549-4000 Toll Free: 1-800-267-0974 Fax: 613-548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Road London, ON N6E 1L3	Tel: 519-873-5000 Toll Free: 1-800-265-7672 Fax: 519-873-5020
Northern Region (east) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie	199 Larch Street, Suite 1201 Sudbury, ON P3E 5P9	Tel: 705-564-3237 Toll Free: 1-800-890-8516 Fax: 705-564-4180
Northern Regions (west) Algoma (West), Cochrane, Kenora, Rainy River, Thunder Bay	435 James Street South, Suite 331 Thunder Bay, ON P7E 6S7	Tel: 807-475-1205 Toll Free: 1-800-875-7772 Fax: 807-475-1745
Standards Development Branch	Pesticides Section 40 St. Clair Avenue West, 7th Floor Toronto, ON M4V 1M2	Tel: 416-327-5519 Fax: 416-327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Avenue West, 12A Floor Toronto, ON M4V 1L5	Tel: 416-314-8001 Toll Free: 1-800-461-6290 Fax: 416-314-8452

APPENDIX E. Other Contacts

AGRICULTURE & AGRI-FOOD CANADA RESEARCH CENTRES

http://www.agr.gc.ca/index_e.php

Eastern Cereals and Oilseeds Research Centre

960 Carling Avenue
Ottawa, ON K1A 0C6
Tel: 613-759-1952

Greenhouse and Processing Crops Centre

2585 County Road 20
Harrow, ON NOR 1G0
Tel: 519-738-2251

Southern Crop Protection and Food Research Centre

1391 Sandford Street
London, ON N5V 4T3
Tel: 519-457-1470

Vineland Research Farm

4902 Victoria Avenue North
Vineland, ON LOR 2E0
Tel: 905-562-4113

Delhi Research Farm

Box 186 Schafer Road
Delhi, ON N4B 2W9
Tel: 519-582-1950

CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.inspection.gc.ca/english/toce.shtml

Belleville

345 College Street East
Belleville, ON K8N 5S7
Tel: 613-969-3333

Brantford

625 Park Rd. N., Suite 6
Brantford, ON N3T 5P9
Tel: 519-753-3478

Hamilton

709 Main Street West, Suite 101
Hamilton, ON L8S 1A2
Tel: 905-572-2201

London

19-100 Commissioners Road East
London, ON N5Z 4R3
Tel: 519-691-1300

Ottawa District

38 Auriga Drive, Unit 8
Nepean, ON K2E 8A5
Tel: 613-274-7374 ext. 221

Toronto

1124 Finch Avenue West, Unit 2
Toronto, ON M3J 2E2
Tel: 416-665-5055

UNIVERSITY OF GUELPH

Main Campus

Guelph, ON N1G 2W1
Tel: 519-824-4120
www.uoguelph.ca

Alfred Campus

Alfred, ON K0B 1A0
Tel: 613-679-2218
www.alfredc.uoguelph.ca

Kemptville Campus

Kemptville, ON K0G 1J0
Tel: 613-258-8336
www.kemptvillec.uoguelph.ca

Ridgetown Campus

Ridgetown, ON N0P 2C0
Tel: 519-674-1500
www.ridgetownc.on.ca

Department of Plant Agriculture

www.plant.uoguelph.ca

Department of Plant Agriculture, Guelph

50 Stone Road West, Guelph, ON N1G 2W1
Tel: 519-824-4120 ext. 56083 or 52693

Department of Plant Agriculture, Simcoe

1283 Blueline Road, Box 587
Simcoe, ON N3Y 4N5
Tel: 519-426-7127

Department of Plant Agriculture, Vineland

Box 7000, 4890 Victoria Avenue North
Vineland Station, ON LOR 2E0
Tel: 905-562-4141

Lab Services Division

www.uoguelph.ca/labserv/
95 Stone Road West
Guelph, ON N1H 8J7

Trace Organic and Pesticide Contaminants

Tel: 519-823-1268

Pest Diagnostic Clinic

Tel: 519-767-6256

APPENDIX F. Diagnostic Service

Samples for disease diagnosis, insect or weed identification, nematode counts and *Verticillium* testing can be sent to:

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. W.
Guelph, ON N1H 8J7
Tel: 519-767-6256
Fax: 519-767-6240
E-mail: pdclsd@uoguelph.ca

Payment must accompany samples at the time of submission. Submission forms are available at <http://www.labservices.uoguelph.ca/units/pdc/>.

Fee Schedule

To obtain information on the fee schedule, refer to <http://www.labservices.uoguelph.ca/units/pdc/> or phone the Pest Diagnostic Clinic.

APPENDIX G. The Metric System

Linear Measures (length)

10 millimetres (mm)	= 1 centimetre (cm)
100 centimetres (cm)	= 1 metre (m)
1,000 metres	= 1 kilometre (km)

Square Measures (area)

100 m × 100 m = 10,000 m ²	= 1 hectare (ha)
100 ha	= 1 square kilometre (km ²)

Cubic Measures (volume)

Dry Measure

1,000 cubic millimetres (mm ³)	= 1 cubic centimetre (cm ³)
1,000,000 cm ³	= 1 cubic metre (m ³)

Liquid Measure

1,000 millilitres (mL)	= 1 litre (L)
100 L	= 1 hectolitre (hL)

Weight-Volume Equivalents (for water)

(1.00 kg) 1,000 grams	= 1 litre (1.00 L)
(0.50 kg) 500 g	= 500 mL (0.50 L)
(0.10 kg) 100 g	= 100 mL (0.10 L)
(0.01 kg) 10 g	= 10 mL (0.01 L)
(0.001 kg) 1 g	= 1 mL (0.001 L)

Weight Measures

1,000 milligrams (mg)	= 1 gram (g)
1,000 g	= 1 kilogram (kg)
1,000 kg	= 1 tonne (t)
1 mg/kg	= 1 part per million (ppm)

Dry-Liquid Equivalents

1 cm ³	= 1 mL
1 m ³	= 1000 L

Metric to Imperial (Approximate)

litres per hectare × 0.09	= gallons per acre
litres per hectare × 0.36	= quarts per acre
litres per hectare × 0.71	= pints per acre
millilitres per hectare × 0.015	= fluid ounces per acre
grams per hectare × 0.015	= ounces per acre
kilograms per hectare × 0.89	= pounds per acre
tonnes per hectare × 0.45	= tons per acre

Imperial to Metric (Approximate)

gallons per acre × 11.23	= litres per hectare (L/ha)
quarts per acre × 2.8	= litres per hectare (L/ha)
pints per acre × 1.4	= litres per hectare (L/ha)
fluid ounces per acre × 70	= millilitres per hectare (mL/ha)
tons per acre × 2.24	= tonnes per hectare (t/ha)
pounds per acre × 1.12	= kilograms per hectare (kg/ha)
ounces per acre × 70	= grams per hectare (g/ha)

Liquid Equivalents

Litres/Hectare	Approximate Gallons/Acre
50	= 5
100	= 10
150	= 15
200	= 20
250	= 25
300	= 30

Dry Weight Equivalents

Grams/Hectare	Ounces/Acre
100	= 1 ½
200	= 3
300	= 4 ¼
500	= 7
700	= 10
Kilograms/Hectare	Pounds/Acre
1.10	= 1
1.50	= 1 ¼
2.00	= 1 ¾
2.50	= 2 ¼
3.25	= 3
4.00	= 3 ½
5.00	= 4 ½
6.00	= 5 ¼
7.50	= 6 ¾
9.00	= 8
11.00	= 10
13.00	= 11 ½
15.00	= 13 ½

Metric Conversions

5 mL	= 1 tsp
15 mL	= 1 tbsp
28.5 mL	= 1 fl. oz

Conversion Tables —Metric to Imperial

Length

1 millimetre (mm)	= 0.04 inch
1 centimetre (cm)	= 0.40 inch
1 metre (m)	= 39.40 inches
1 metre (m)	= 3.28 feet
1 metre (m)	= 1.09 yards
1 kilometre (km)	= 0.62 mile

Area

1 square centimetre (cm ²)	= 0.16 square inch
1 square metre (m ²)	= 10.77 square feet
1 square metre (m ²)	= 1.20 square yards
1 square kilometre (km ²)	= 0.39 square mile
1 hectare (ha)	= 107.636 square feet
1 hectare (ha)	= 2.5 acres

Volume (dry)

1 cubic centimetre (cm ³)	= 0.061 cubic inch
1 cubic metre (m ³)	= 1.31 cubic yards
1 cubic metre (m ³)	= 35.31 cubic feet
1,000 cubic metres (m ³)	= 0.81 acre-foot
1 hectolitre (hL)	= 2.8 bushels

Volume (liquid)

1 millilitre (mL)	= 0.035 fluid ounce
1 litre (L)	= 1.76 pints
1 litre (L)	= 0.88 quart
1 litre (L)	= 0.22 gallon (Imp.)
1 litre (L)	= 0.26 gallon (U.S.)

Weight

1 gram (g)	= 0.035 ounce
1 kilogram (kg)	= 2.21 pounds
1 tonne (t)	= 1.10 short tons
1 tonne (t)	= 2.205 pounds

Pressure

1 kilopascal (kPa)	= 0.15 pounds/in ²
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Speed

1 metre per second	= 3.28 feet per second
1 metre per second	= 2.24 miles per hour
1 kilometre per hour	= 0.62 mile per hour

Temperature

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$$

Conversion Tables – Imperial to Metric

Length

1 inch	= 2.54 cm
1 foot	= 0.30 m
1 yard	= 0.91 m
1 mile	= 1.61 km

Area

1 square foot	= 0.09 m ²
1 square yard	= 0.84 m ²
1 acre	= 0.40 ha

Volume (dry)

1 cubic yard	= 0.76 m ³
1 bushel	= 36.37 L

Volume (liquid)

1 fluid ounce (Imp.)	= 28.41 mL
1 pint (Imp.)	= 0.57 L
1 gallon (Imp.)	= 4.55 L
1 gallon (U.S.)	= 3.79 L

Weight

1 ounce	= 28.35 g
1 pound	= 453.6 g
1 ton	= 0.91 tonne

Pressure

1 pound per square inch	= 6.90 kPa
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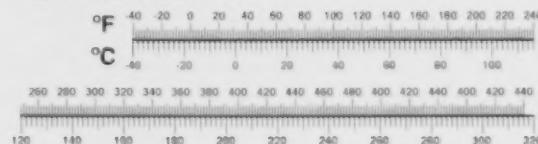
Temperature

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$$

Abbreviations

%	= per cent (by weight)	km/h	= kilometres per hour
ai	= active ingredient	kPa	= kilopascal
AP	= agricultural powder	L	= litre
cm	= centimetre	m	= metre
cm ²	= square centimetre	m/s	= metres per second
DG	= dispersible granular	m ²	= square metre
DP	= dispersible powder	mL	= millilitre
E	= emulsifiable	mm	= millimetre
e.g.	= for example	SC	= sprayable concentrate
EC	= emulsifiable concentrate	SP	= soluble powder
F	= flowable	t	= tonne
g	= gram	W	= wettable (powder)
Gr	= granules, granular	WDG	= water dispersible granular
ha	= hectare	WP	= wettable powder
kg	= kilogram	km/h	= kilometres per hour

TEMPERATURE



For exact values the formula is:

Fahrenheit to Celsius: subtract 32 from number of °F, then multiply by $\frac{5}{9}$

Celsius to Fahrenheit multiply °C by $\frac{9}{5}$ then add 32

APPENDIX H. Herbicide Companies and Agents

CODE	NAME	PHONE	WEBSITE
ADJ	ADJUVANTS PLUS INC.	1-877-512-4659	www.adjuvantsplus.com
AGR	AGRIUM ADVANCED TECHNOLOGIES	1-519-757-0077	www.agriumat.com/ca
BAZ	BASF CANADA INC.	1-877-371-2273	www.agsolutions.ca
BCZ	BAYER CROPS SCIENCE INC.	1-877-938-3737	www.bayercropscience.ca
CAU	CHEMINOVA CANADA	1-888-316-6260	www.cheminova.com
CRE	CROMPTON CORPORATION	1-800-265-2156	www.chemtura.com
DUQ	DUPONT CANADA INC.	1-800-667-3925	www.dupont.ca/ag/
DWE	DOW AGROSCIENCES CANADA INC.	1-800-667-3852	www.dowagro.com/ca
ENR	ENVIROSCIENCE LABORATORIES INC.	1-800-567-1191	www.wateronnet.com
ENF	THE ENVIRONMENTAL FACTOR	1-905-571-5824	www.environmentalfactor.com
GOW	GOWAN COMPANY	1-800-883-1844	www.gowanco.com
GRN	GRIFFIN CORP.	1-912-242-8635	www.griffinllc.com
INT	INTERPROVINCIAL COOPERATIVE LIMITED	1-204-233-3461	www.ipco.ca
MOX	MONSANTO CANADA INC.	1-800-667-4944	www.monsanto.ca
NOC	NORAC CONCEPTS INC.	1-519-821-3633	www.noracconcepts.com
NUA	NUFARM AGRICULTURE INC.	1-800-868-5444	www.nufarm.ca
PLG	PLANT PRODUCTS CO. LTD.	1-800-387-2449	www.plantprod.com
SAR	SARRITOR		www.sarritor.ca
SGF	SCOTTS CANADA LTD.	1-800-668-5669	www.scottscanada.ca
SYZ	SYNGENTA CROP PROTECTION CANADA INC.	1-800-459-2422	www.syngenta.ca
TES	TESSENDERLO KERLEY INC.	1-515-201-2649	www.NovaSource.com
TIU	ECOVAL	1-866-298-2229	www.ecoval.ca
UAG	UNITED AGRI PRODUCTS	1-800-265-4624	www.uap.ca
VAJ	VALENT CANADA INC.		www.valent.ca
WBR	WILBUR-ELLIS COMPANY OF CANADA LTD.	1-306-242-4553	www.wilburellis.com

APPENDIX I. Important Weed Management Websites

ONTARIO PESTICIDES ADVISORY COMMITTEE	1-416-314-9233	www.opac.gov.on.ca
OMAFRA WEEDS PAGE		ontario.ca/crops
PRODUCT LABELS		pr-rp.pmr-arla.gc.ca/pub_reg/pls
CANADIAN WEED SCIENCE SOCIETY		www.weedscience.ca
HERBICIDE RESISTANT WEEDS IN ONTARIO		www.plant.uoguelph.ca/resistant-weeds/
HERBICIDE SELECTOR – CORN, CEREALS (ONTARIO)		www.weedpro75.com
RIDGETOWN COLLEGE WEEDS PAGE		www.ridgetownc.com/services/weeds_index.cfm
WEED IDENTIFICATION – ONTARIO		www.ontarioweeds.com

APPENDIX K. Spraying Application Record

Application Equipment Used:

Tank Capacity:

Nozzle Type and Pressure:

Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate per Hectare or Acre:

[illegible]

APPENDIX J. Responsible Glyphosate Use in Field Crops

Glyphosate and Roundup Ready crops are valuable weed management tools, however:

- The risk of glyphosate resistant weeds will increase if glyphosate is managed improperly.
- In the United States, there are populations of common ragweed, common waterhemp, Canada fleabane, giant ragweed and pigweed spp. resistant to glyphosate.
- No new herbicides are currently being developed to replace glyphosate.

There is a tremendous opportunity for Ontario Growers to become leaders in the stewardship of glyphosate. The Ontario Weed Committee has devised the following guidelines for responsible glyphosate use that is intended to minimize the risk of glyphosate resistant weeds.

1) Know What You Have

- Scout fields for weed species and density. If this is beyond your area of interest or expertise then hire a certified crop adviser to do so for you.

2) Develop A Plan

- Once your field has been scouted and you know what weed species you have, sit down with your certified crop adviser and develop a long-term management plan to address your weed spectrum.

Your Plan Should Consider:

"THE SEVEN STEPS OF RESPONSIBLE GLYPHOSATE USE"

1. Use "Roundup Ready" technology in fields where it will have the greatest economic benefit.
2. Rotate "Roundup Ready" crops with conventional or other herbicide tolerant crops as well as rotate herbicides with different modes of action.

3. Always use the full labelled rate of glyphosate.
4. Tank-mix glyphosate with residual herbicides where appropriate.
5. Use cultivation where appropriate.
6. Scout for and report any suspected glyphosate-resistant weeds to 1-877-424-1300.
7. Control and prevent the spread of weed escapes.

**For more information on
herbicide resistance visit:**

www.plant.uoguelph.ca/resistant-weeds

Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment at
1-800-268-6060.

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto 1-800-268-9017
1-877-750-2233 (TTY)

PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label **BEFORE** you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.



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IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

FIRST AID

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

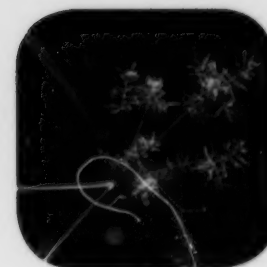
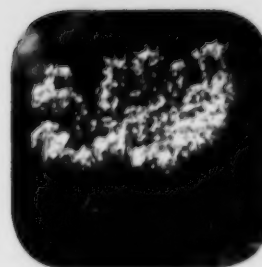
If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

Emergency numbers are listed at the front of each Bell telephone directory.

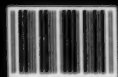
To obtain copies of this or any other OMAFRA publication, please order:

- online at www.serviceontario.ca/publications
- by phone through the ServiceOntario Contact Centre, Monday to Friday, 8:30 AM to 5:00 PM ET
 - 416-326-5300
 - 416-326-3408 (TTY)
 - 1-800-668-9938, toll-free across Canada
 - 1-800-368-7095 (TTY), toll-free across Ontario
- in person at ServiceOntario Centres across Ontario



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syngenta



ontario.ca/crops

